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FLYING's *Airsedan* *The editors present their post-war lightplane, incorporating the latest practical features of modern aeronautical design.*

SEE PAGE 34.

Workhorse Power

CYCLONE 18

Planes powered by Wright Cyclone 18's carry more pounds —in bombs, gasoline, passengers or cargo—than any other aircraft.

In the Lockheed Constellation and Boeing C-97, they carry loads at speeds no other transport can match. In the Martin Mars, they carry cargo at a new low for ton mile costs. In the Boeing B-29, they have carried more bombs over a greater range than any other plane ever sent into action. In still other planes, not yet released, Cyclone 18's continue their record performance.

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FLYING

AUGUST, 1945

VOLUME 37 • NUMBER 2

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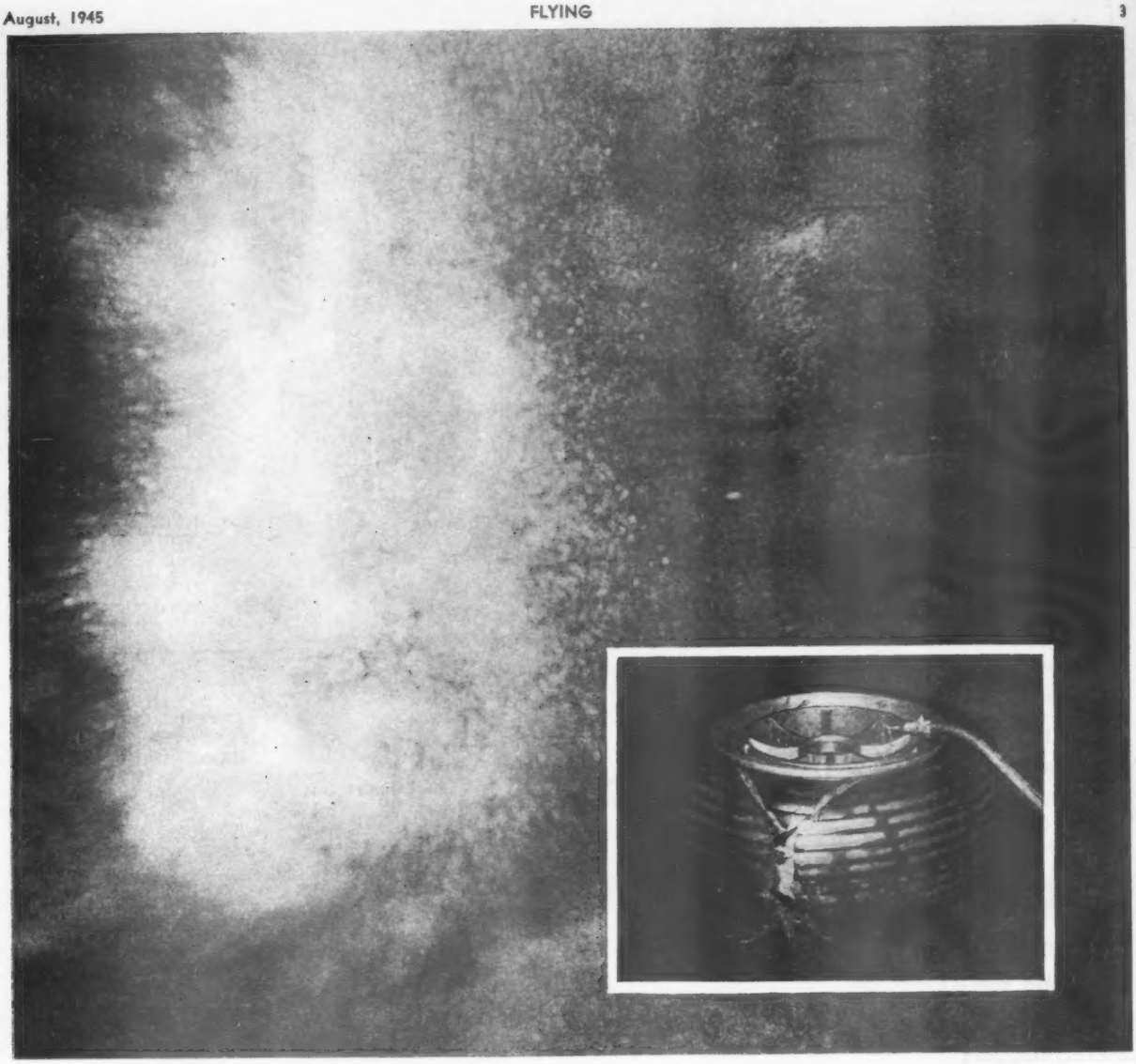


Tire explodes at 635 . . .

Another example of "Building for today, testing for tomorrow"

OUR PHOTOGRAPHER waited hours to take this picture of a tire exploding. As a needle-like stream of water was forced into it, the internal pressure went up . . . to twice as much as the tire would normally need to take . . . three times . . . five times . . . six times . . .

Suddenly, at a pressure of 635 pounds, it exploded! The picture our photographer had awaited so patiently turned out to be mostly a geyser of water. But the smaller picture shows what happened. The bead and sidewalls, the parts most likely to fail, held until the tremendous pressure tore through the crown of the tire.

Such things shouldn't be done to tires except in test. This tire needed an extra safety factor for a special purpose. But pushing tires beyond endurance, and doing it scientifically, is one method of B. F. Goodrich development. We call it testing for tomorrow. Ordinary passenger car tires are driven at 100 miles an hour, because they may someday have to operate safely at such speeds.

Airplane tires are tested at greatly multiplied pressures, because tomorrow's planes may require it. Nobody knows how flying conditions may change in the years ahead. But B. F. Goodrich expects to have tires and other aviation products that meet the conditions—no matter what they are!

Looking ahead—testing for tomorrow enabled B. F. Goodrich to produce the first tire engineered and built especially for airplanes, and today more than 80 rubber and synthetic rubber products for airplanes are manufactured by the company. These include de-icers for wings and other leading edges, bullet-sealing fuel cells, grommets, cushions for instrument panels and many others. *The B. F. Goodrich Company, Akron, Ohio.*

Skyway or Highway

B.F.Goodrich

FIRST IN RUBBER

POST WAR AVIATION OPPORTUNITIES
Bulletin

VOLUME 1 NUMBER 10

Fixed Base Operation— Its Meaning and Opportunities

(PART 2)

The previous Bulletin referred to airport or fixed base revenue as coming from three main sources: rentals, concessions and field fees. A more detailed explanation of these revenues will be dealt with herein.

HANGAR RENTALS

Personnel who have saved sufficient capital to invest in a hangar may expect to receive rental returns ranging from a low of $10 to a high of $100 per month per airplane,* judging from fairly well-accepted practice. Charges are usually made on either the number of feet an airplane occupies or the wingspread footage of the craft.

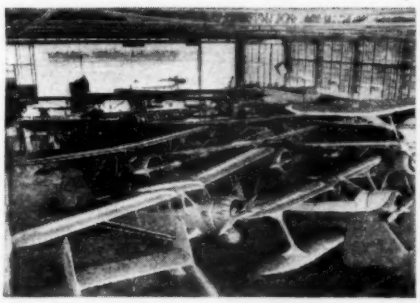
Usually a flat monthly rental is charged. The charge for overnight hangar storage for transient craft may also be estimated by the above method, plus a knowledge of customary plane traffic. The average charge now ranges from $1 to $5.

LANDING FEES

There is no standardized charge for landing fees at present. Some fields permit free landings. Others with heavy airline traffic may charge anywhere from $1 per landing to $15. (Landing fees at La Guardia Field, New York, are based on the weight of the plane.) In general, of course, landing fees accrue to the airport owners—usually the city—but such fees or their lack may well influence the amount of traffic prospective operators might expect from private craft and should be investigated before investments are made. Planes operated by the airlines are often serviced by local fixed base operators.

CONCESSIONS

Few airports have the same policy on concessions. Some have no concessions, preferring to administer all phases of airport activity, from the restaurant to hangar rentals and repair work. Most, however, lease space and sell concessions to private operators. Concessions are important sources of income to their operators since they usually enjoy exclusive rights in their line to all the airport trade.



With proper stowing, the average hangar can accommodate many planes of various types. (Courtesy—Pacific Airmotive.)

GAS AND OIL CONCESSIONS

These are handled in one of three ways: the airport operates the concession, an oil company may handle it, or it may be leased to an operator or supply concern. The sale of gasoline and oil, unlike restaurant and shop concessions, is frequently contracted on a competitive basis exclusively granted to the low bidder. However, as plane owners frequently have a definite preference, a single brand of oil or gas may not meet all requirements. In such cases, particularly at the larger airports, a variety of brands may be provided.

SUPPLY AND REPAIR SHOPS

Many small airports handle their own work. Concessions in this line are normally on a straight rental basis of the facilities or space. This merely means that those wishing to establish themselves in fixed base operation around a small town cannot always secure a concession and may have to seek employment from the airport . . . Sales of aircraft parts and supplies normally develop into a concession where the business warrants.

OTHER REVENUES

War conditions have temporarily suspended many normal sources of airport revenue, but postwar flying is certain to increase the income ordinarily derived from such activities as flying schools, charter services, plane rentals, passenger rides, etc. In addition, motels, drive-ur-self car and taxi franchises, parking lots, bowling alleys, swimming pools, golf links, etc., may be expected to develop as logical postwar accessories to large national and international terminals.

Actually, these terminals will be small cities in themselves with all the activities which accompany such concentrations.

(Note: This is the second of three Bulletins on the subject of fixed base operation and its postwar potential for members of the air forces.)

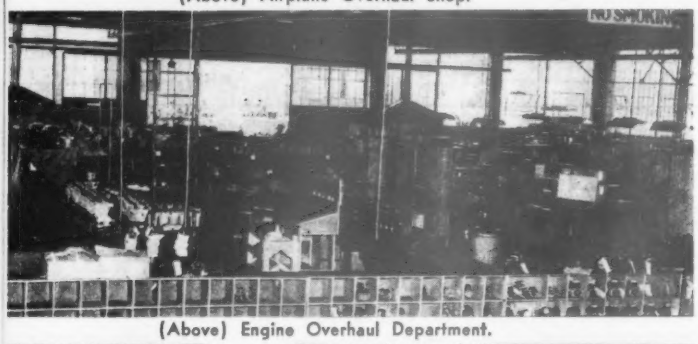
The tenth in a series of bulletins designed to acquaint ground and flight personnel of the Army, Navy and Marine Air Corps with new developments in the field of commercial aviation. Union Oil Company does not believe the war is won, but we do think many members of the air forces are wondering what they will do when peace comes. We believe they will be interested to know of any opportunities which exist for them. Inquiries are welcome, and we will be glad to furnish information to interested personnel. Address—Aviation Dept., Union Oil Company, Room 700B, 617 W. Seventh Street, Los Angeles 14, California.

* (Personnel should bear in mind that all figures given are estimates based on an average of fixed base operation everywhere and cannot be construed as a guarantee, since the law of supply and demand governs.)

AVIATION DEPARTMENT
UNION OIL COMPANY
OF CALIFORNIA

76

(Above) Airplane Overhaul Shop.



(Above) Engine Overhaul Department.

(Above) Instrument Repair and Overhaul Department.

(Above) Propeller Repair and Overhaul Department.

(Above) Radio Manufacturing and Repair Department.

100% Approved Aircraft Overhaul and Repair Service

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In the Heart of the Nation

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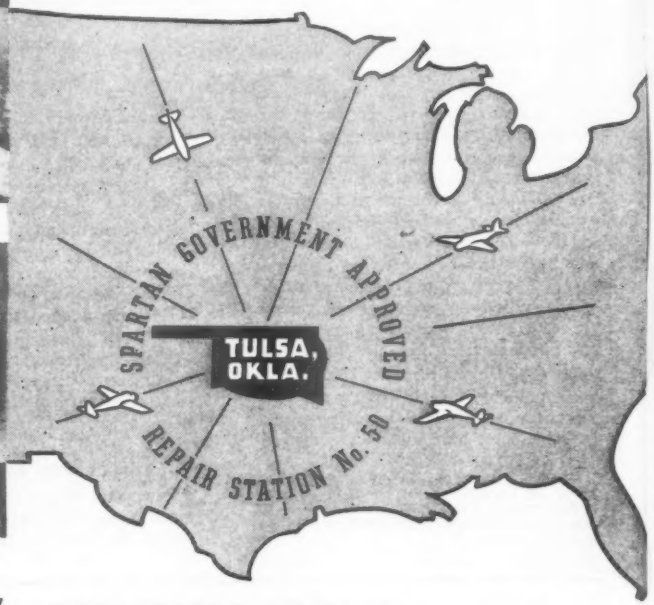
WRITE NOW FOR CATALOG—Gives you an interesting and informative picture and word story of the wide scope of service provided at SPARTAN. It's free!



SPARTAN AERO REPAIR

Division of SPARTAN AIRCRAFT COMPANY

TULSA, OKLA. Established 1928

Orientation mechanically has now become a fact! Today a pilot or navigator can read directly from a dial his exact position in relation to the air mass through which he travels. With only a simple correction for drift he can establish, *with accuracy*, his geographical position as well. The instrument which makes this possible could only have come from Pioneer*, for the proper functioning of the Air Position Indicator depends in large part on true heading indications—and these in turn can be provided under all conditions only by the Pioneer-created Gyro Flux Gate* Compass. Again Pioneer's Creative Engineering points the way to greater flight security.

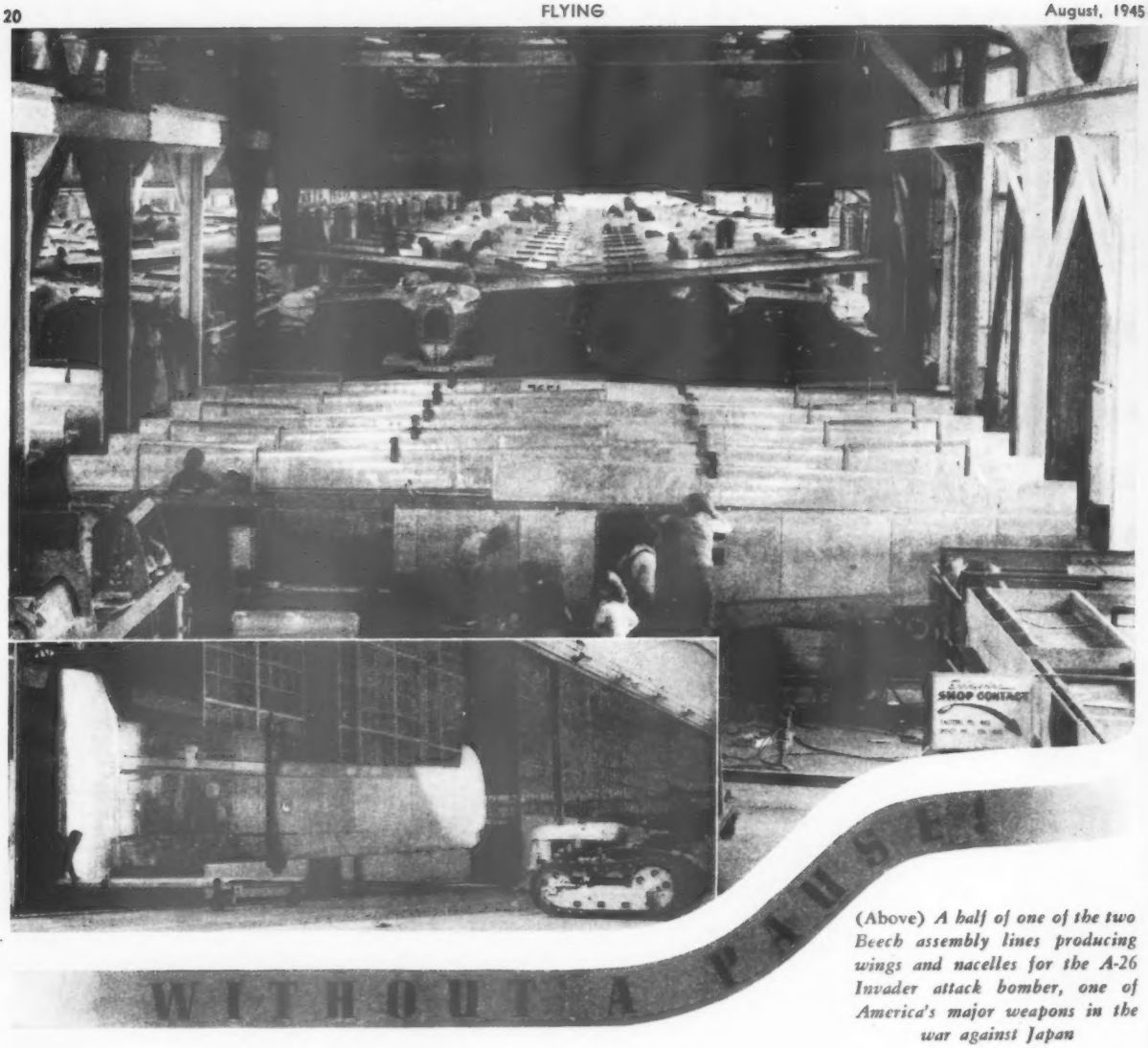
PIONEER INSTRUMENTS

*REG. U. S. PAT. OFF.

PRODUCTS OF Bendix

ECLIPSE-PIONEER DIVISION AVIATION CORPORATION

Teterboro, N. J.



(Above) *A half of one of the two Beech assembly lines producing wings and nacelles for the A-26 Invader attack bomber, one of America's major weapons in the war against Japan*

SHORTLY before V-E Day, the 1000th set of A-26 Invader attack bomber wings and nacelles built by Beechcraft rolled onto the loading ramp with neither pomp nor ceremony. Beechcrafters were too busy planning for the other thousands to follow to pay any attention to this milestone.

Beechcrafters know that the war is not over until Japan has surrendered unconditionally. And Beechcrafters want to help finish the job in the shortest possible time. They have met every assignment and every production schedule ever given to them. Even as the 1000th set of A-26 wings and nacelles came off the assembly line without causing a moment's pause in their work, so they carry on at quickened tempo until V-J Day. Beechcrafters will continue to meet all their commitments and obligations to our Armed Forces and in addition will have peacetime Beechcrafts ready for delivery at the proper time.

Beech Aircraft
CORPORATION

BEECHCRAFTS ARE DOING THEIR PART WICHITA, KANSAS, U. S. A.

WAS AIR POWER A SUCCESS?

Evidence suggests that bombs were decisive in Europe only because Germans did not have time to build up their underground jet plane factories.

Burning ammunition stores at Klein Engstingen symbolize accomplishments of air power.

By
CURTIS FULLER
Assistant Managing Editor of FLYING

IN the May-June issue of *Army Ordnance*, Maj. Gen. J. F. C. Fuller, the British military analyst, bluntly charged: ". . . air attack on the enemy industrial centers and on his civil population, as advocated by Douhet and others, proved the greatest military fiasco of the war."

The defeated German generals, on the other hand, have called Allied airpower the decisive factor in our victory, and the claims of some of our own top air commanders are short of that only through modesty. The joint statement of the U. S. Strategic Air Forces in Europe and the British Air Ministry asserts that "strategic bombing prepared the way for the ground forces." General Eisenhower sent a message to General Marshall last September, declaring that "the air has done everything we asked."

Allied airpower was far from being a fiasco. It is the contention of this article that history, like the defeated German generals, will judge it as decisive in winning the European war—but with some qualifications. It was decisive only because of serious mistakes made by the German air and production strategists, and only within the limits of the time of the invasion and comparative technical advance of the contending powers. A year later, because of developments discussed here, and the Germans might well

Shattered Hannover typifies the success of our bombers. But what if the underground plants could have built thousands of jet fighters in time? Some underground plants were building V-weapons able to bomb the U.S.

have regained control of the air over Germany.

But because General Fuller's charges are typical of those we are likely to hear during the post-war years—just as we heard a similar controversy about airpower between the two great wars—they should be investigated now as far as our information permits us to do so. General Fuller asserts:

"Not that immense damage was not done [by airpower], for it was—damage, human and cultural, which puts to blush the destruction wrought by Goth, Vandal, Lombard and Hun. But instead of annihilating the enemy's industries, it scattered them, and instead of forcing his civil population to revolt, it stimulated their will to fight. To have proved effective, air attack should have been directed against the sources of industrial power and not against the industries themselves. Had the German coal fields and synthetic oil plants been kept under constant bombardment, in time all the German heavy industries would have had to close down."

What are General Fuller's charges in detail? Let us number them in the order he makes them:

1. We did not annihilate the enemy's industries.

2. We scattered the enemy's industries instead.

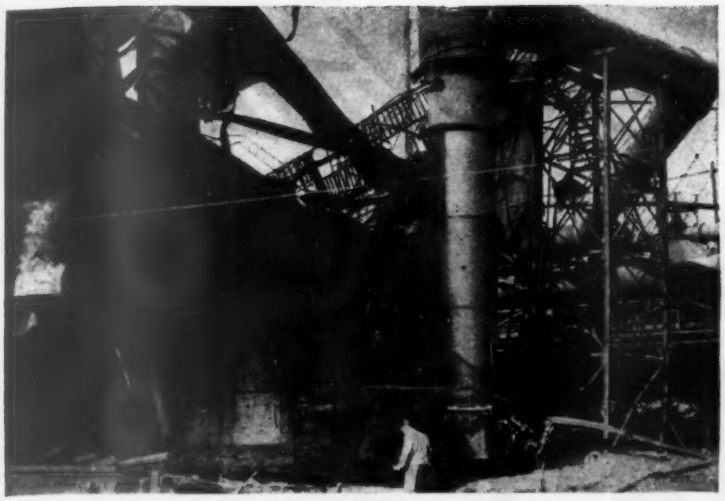
3. We did not force the enemy's civil population to revolt.

4. We stimulated the enemy's civil population's will to fight.

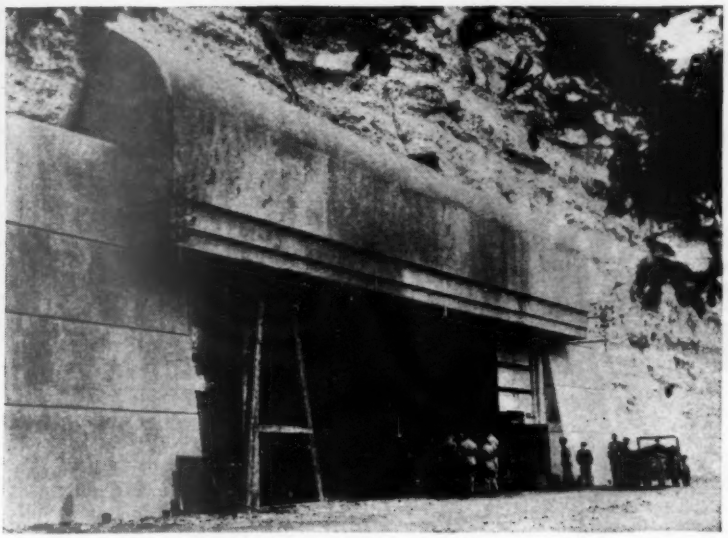
5. We did not bomb the sources of industrial power—the coal fields and synthetic oil plants.

6. If we had bombed these sources of industrial power, the enemy's industries would have had to close.

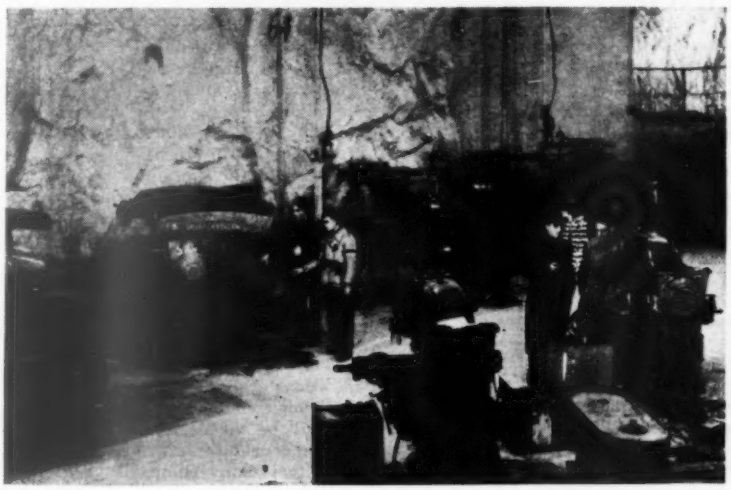
These charges will be examined in detail, but by way of a preface it should be stated that the strategic aim of the U. S. Army Air Forces, at least in recent years, was not, as General Fuller implies, the total aim of Douhet who believed the enemy could be defeated by airpower alone. It was a decidedly more limited objective—to make victory easier by destroying the enemy's industrial means to make war. As such, we aimed at the enemy's strategic industry and—a point not mentioned by General Fuller—at his



Nazi oil was a primary objective. Destruction of the Leuna synthetic oil works at Merseburg helped to knock out 95 per cent of German oil production by VE-day.



Entrance, above, and workroom of underground aircraft factory at St. Astier, France. Our troops found it full of machinery moved from the Bacalan, Merignac and Begles plants. The Nazis found such underground factories were invulnerable to bombing.



strategic land and sea communications.

A non-partisan commission of experts soon will appraise the results of our strategic bombing of Germany. When their report is made, presumably, we shall have the facts. Meanwhile it is possible to make some appraisal of the effects of this bombing and, more important, evaluate it in terms of the entire war. But we should remember always that much cannot be told because it might be useful to the Japanese and that the available data is, quite naturally, weighted in favor of the air forces which compiled and released most of it.

The biggest criticism of our information, however, is that it is qualitative and not quantitative. We have excellent eye-witness accounts but we have precious few statistics. Our eye-witness accounts are enormously impressive—but they also reflect both the enthusiasms of the reporters and the inclinations of the censors.

The first of General Fuller's charges is that we did not annihilate the enemy's industries. That is certainly true, but, equally true, we did them grave damage. Here is a bird's-eye view of some of that damage.

Aachen is a roofless ruin. In Dueren, once a city of 100,000, only a few fragments of walls remain. From there all the way to Cologne is but a repetition of the same destruction. Cologne itself is 80 to 90 per cent destroyed—"a ruined, silent city"—with eight or nine out of every 10 buildings uninhabitable or unusable and an estimated 2,000 out of its 3,300 built-up acres wiped out. In Bonn, the ancient university city, more than half of the buildings were destroyed.

Frankfort was one of the grandest cities of the Reich. Today you can stand at one intersection in the center of the city and cannot see a building in any direction. The shopping district is a burned-out mass of concrete and stone.

Berlin no longer is the proud capital of Germany. It has been wiped from the map. Joseph W. Grigg, United Press correspondent representing the combined Allied press, described it as "a hideous, nightmarish labyrinth of ruins beyond all hope of repair or rebuilding. Only on its outskirts does it even remotely resemble a city where human beings can live." No water mains are working. Russian Army vehicles churn the dust of the streets into swirling clouds that blot out visibility like miniature Sahara dust storms.

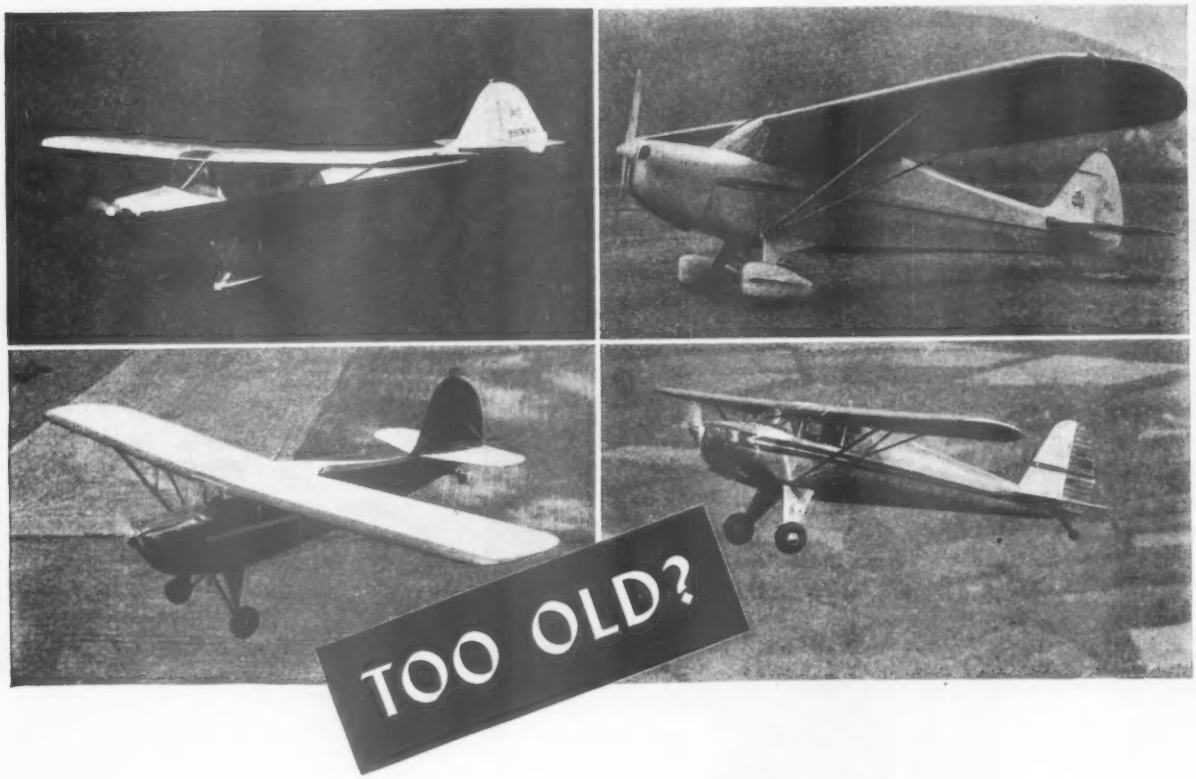
But not all of Germany was as damaged as were the Ruhr, Rhineland and Saar areas. Comparatively few scars were found in inner Germany. Heidelberg was little damaged, spared even by artillery. Westphalian towns were unbombed and prosperous. Our half-tracks drove past castles of unmarred beauty and the fat cattle grazed peacefully in the green fields.

A first tour among the ruins of the industrial cities often left the impression that Germany had nothing left when she surrendered. But our occupation forces soon uncovered many hidden factories.

Even along the Rhine, dozens of

(*Continued on page* 102)

The Lightplane



Business expert sees sound sales and distribution as the key to successful lightplane manufacturing.

By LYNN L. BOLLINGER

We believe this to be one of the most important articles of its kind to be written in recent years. It is a sober, practical analysis of one of civil aviation's most pressing problems. The author is assistant professor of business administration, Harvard Graduate School of Business Administration, and is a former fixed-base operator. This article first appeared in the Winter, 1945, issue of the Harvard Business Review.—Ed.

WHETHER the maximum annual sales of personal aircraft during the first few years after the war will be 10,000 or 100,000 is a question on which the experts disagree. The best-informed judgments appear to agree that no mass market exists for personal airplanes at their present stage of development and cost. Even if the most optimistic of these estimates is fulfilled, the present prospects are that the market will be so divided among a large number of manufacturers that few will be able to attain a profitable volume on this type of plane. The only companies that have a fair chance of succeeding are those which will be able to combine progressive design with sufficiently effective merchandising to solve the peculiar distribution problems confronting the industry.

An informed estimate indicates that as many as 55 manufacturing companies may seek post-war participation in the personal plane market. Inclusion of companies experimenting with helicopters would add substantially to this total. A number of the potential new entrants into the private plane field have never produced any aircraft and some do not appear able to offer serious competition. Others, however, have accumulated millions of dollars in other industries during recent years, and now view the aviation field with a hopeful eye. In more than one instance, models are being quietly developed at locations apart from the parent plant. Some, of course, may never go into production.

That the high mortality rate among personal plane manufacturers will parallel that of early automobile companies appears likely. Many of the determining factors may prove strikingly similar. As with automobiles, progressiveness in styling and merchandising may often outweigh a competing model's mechanical advantages. Lower production costs likewise may frequently be determined more by relative sales volumes than by differences in engineering skill; the individual manufacturer's relative sales volume in turn will be dependent in large part upon the effectiveness of his distribution system. The size and character of dealer organizations also will determine the customer's choice in many instances where service will be the deciding factor. Despite these considerations, there is strong evidence that many companies are con-

Dilemma . . . PART ONE

centrating on engineering and production plans to the exclusion of merchandising aspects. They are probably making a serious mistake.

Managements at each of the numerous companies now planning to enter the market appear supremely confident that they have that extra something which will make their company one of the few to survive. A review of the plans of a representative cross section of these manufacturers, however, has made possible certain guesses concerning various pitfalls which may eliminate the less fortunate.

Most of these companies have found little difficulty in obtaining an experienced aeronautical engineer who will build the "perfect small airplane." Usually it looks good and flies well. However, a reasonable guess would be that probably not more than 40 of the 55 possible entrants in the field are capable of developing planes with sufficiently good performance characteristics to satisfy His Majesty, the buyer.

In contrast to the period following World War I, today most of the entrants into this field have a reasonable knowledge of manufacturing and are designing with production in mind. A fair guess might be that at least 30 out of the possible 40 companies with good aerodynamic designs will also be close enough to the minimum present-day production costs to compete successfully. These companies might well average at least two different models apiece, so that we may reasonably contemplate the possibility that 60 moderately priced models with good flying characteristics may be offered to the public during the immediate postwar years.

The apparently modest size of the immediate demand, together with certain peculiarities of the marketing problem, suggests that only a few out of the 30 or so originally "successful" entrants may, at the end of five years, prove to have had profitable ventures. Many, of course, will fall out because of inadequacies in design; a larger proportion than generally expected, however, will probably be commercial failures solely because of shortcomings in merchandising and distribution.

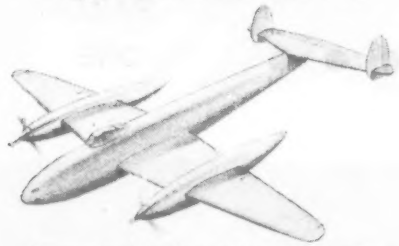
Inasmuch as there is now widespread aeronautical engineering skill, it will be surprising if any one company's lightplane soon attains performance characteristics which represent a revolutionary advance over all others. It may be assumed that each of the 30 or so companies whose prospects we are now considering will produce an aerodynamically sound machine adapted to economical production. The additional pitfalls with respect to design can best be described as errors in "timing."

The most obvious error in timing will be made by those companies which adhere to designs that are already obsolete either in performance or in consumer appeal. In view of the present shortage of serviceable aircraft, a substantial market may exist for a limited period for the pre-war high-wing, external-strut "grasshopper." An appreciable number of these slow-flying types may be sold at the outset, especially to fixed-base operators and flying clubs for training purposes. Private buyers, however, probably will soon demand "cleaner" configurations, with styling that appeals to their pride of ownership and with better performance at low horsepower in order to increase utility for cross-country flying.

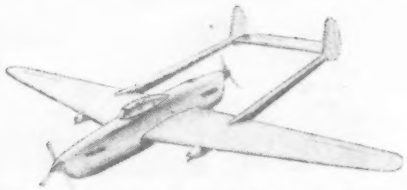
The other danger of design timing is that of being too far advanced. There will probably be more commercial failures on this score than from being too far behind. Many companies at present

(*Continued on page 110*)

Design Ideas that led to the P-38



Conventional fuselage with twin tail unit.



Twin booms, and tractor and pusher engines.

Engines in fuselage, geared to props in wing.

Fuselage engines side by side, pusher props.

A bright page in the history of American military aviation is turned, as production of the Lockheed Lightning tapers off.

The Fork-Tailed Devil

TO THE Germans the P-38 was *"der Gabelschwanz Teufel"*—fork-tailed devil. The Japs call it "Two Airplanes With One Pilot." The British dubbed it *Lightning*—and that name stuck. It earned its reputation from the outset of the war, racking up a long row of "firsts"—the first U. S. plane to shoot down an enemy plane after our entry into the war (a Focke-Wulf over Iceland); first over Tokyo after Doolittle's famous "Shangri-La" raid; first photo plane over Formosa; first fighter to land on Leyte and Luzon in the recent Philippine invasion, and the first land-based plane to land on Iwo-Jima to provide fighter cover.

More than 6,500 *Lightnings* have rolled off Lockheed and Consolidated Vultee production lines, although the *Lightning* was an "obsolescent" airplane from the first, avoiding becoming obsolete for years because of its design versatility.

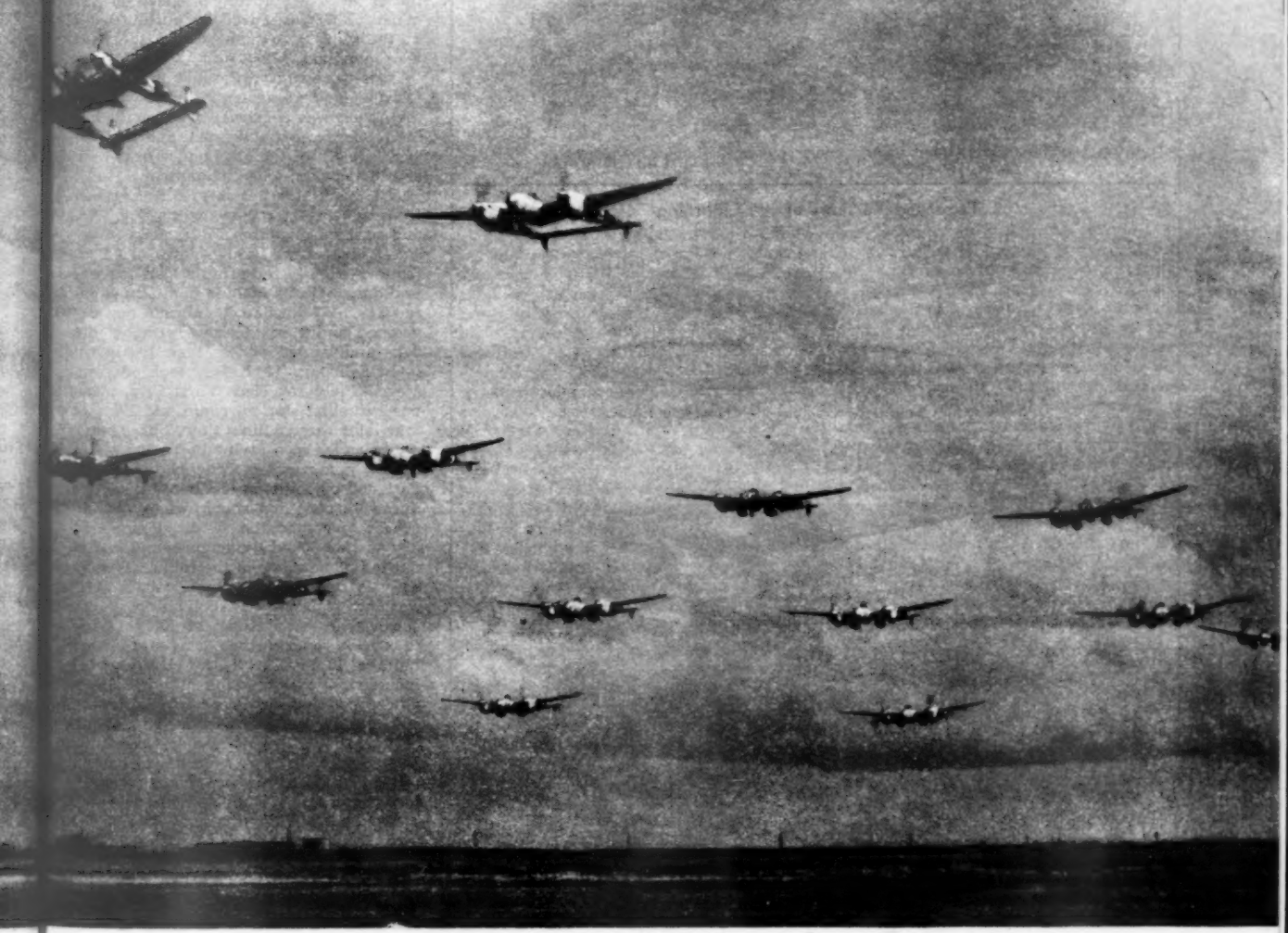
With the war against Germany ended, Lockheed is tapering off P-38 production to push production of newer models, including the jet-propelled *Shooting Star*. Thus the *Lightning* is about to take its rightful place in aviation history.

The P-38 was born early in 1937, when the U. S. Army Air Corps sent manufacturers specifications for a single-seat military airplane—specifications which set up rigid performance requirements. Lockheed had never produced military aircraft. It then was a small company with fewer than 2,000 employees, and had produced only 107 aircraft during its entire history.

Numerous designs were proposed. First sketched was a twin-engined fighter with conventional fuselage and twin rudders [see sketches accompanying this article]. Next, a pusher-tractor type with twin engines mounted fore and aft of the pilot's gondola, with twin booms reaching the now-famous twin tail. Then came a conventional fuselage design with two engines housed behind the pilot, with only the pusher blades projecting from the trailing edges of the wing, one on each side of the fuselage. This was followed by a similar proposal, but with the propellers on the leading edge of the wing. From the fifth and final drawing was evolved the basic design of the P-38.

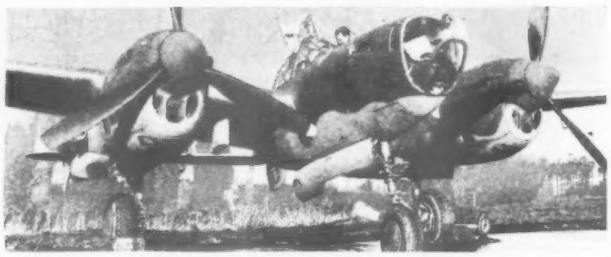
The two-engine design, with guns mounted in a central nacelle and firing straight ahead, promised the pilot better visibility, more effective concentration of firepower and avoidance of synchronizing firepower with the speed of the propellers. Twin booms did not comprise an attempt at streamlining but stemmed

Lightnings of the 15th Air Force buzz a field in Italy after escorting heavy bombers to Austria. This unit was the oldest fighter group in AAF

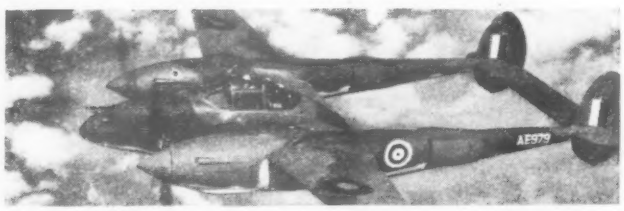


Lightning Prototype and Offspring

Here is XP-38, from which evolved all subsequent Lightning versions.

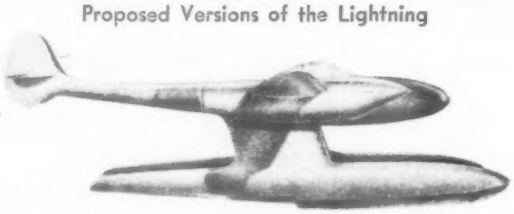


"Droop-snoot" bomber had Norden bombsight, bombardier, was used in ETO.

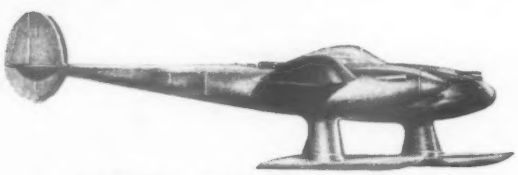


British model lacked superchargers or opposite-turning propellers.

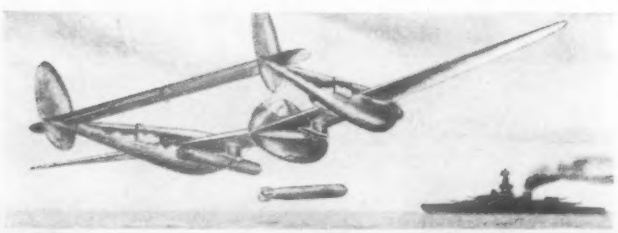
Proposed Versions of the Lightning



Here is how proposed twin-float Lightning would look.



One P-38 ski plane with full-retracting skis was built.



P-38 torpedo-bomber carried torpedoes under wing, was actually tested.

from the business of solving the major problem in *Lightning* design—what to do with its turbosuperchargers. Placed within the fuselage, their bulk would have made streamlining impossible, so the engine nacelles were extended back of the wing to house the two superchargers. Once this was done it seemed logical to extend them still further and join them with the horizontal stabilizer.

Design specialists finally agreed that "this was it". Performance calculations, photographs of a mockup and drawings of the structure were submitted to the Army. A contract was signed in June, 1937. Where contemporary fighter planes lifted from 20 to 25 pounds with each foot of wing area, the prototype (designated XP-38) boosted wing loading to 35 pounds without sacrificing speed or maneuverability. Wing surface loss was offset by reduced drag and added power, and Lockheed-Fowler flaps were grafted to the design to aid in take-off and to permit slow landing speeds. Two 980-h.p. Allison V-1710-C9 liquid-cooled engines provided the power. It is significant that the length and span of the P-38 has always remained constant.

In wind tunnel tests the aerodynamically new wing wanted to flop on its back. Another wing developed a flap flutter at a wind tunnel speed of 150 m.p.h. This was cured by putting holes in the wing at a point where the flaps were attached.

Tests were run on the new and radical tricycle landing gear. A three-wheeled tow truck was constructed and pulled at high speeds, carrying the approximate gross weight of the airplane. These tests eliminated nose-wheel shimmy.

The hand-built prototype first rolled from its hangar on New Year's Eve, 1938, and trucked to March Field, near Riverside, Calif., where Lieut. (now Col.) Benjamin F. Kelsey ran ground tests for several days. On its maiden flight, on January 27, 1939, the flap link broke and developed a flutter. Kelsey retracted the flaps and landed at less than 100 m.p.h.

On February 11, Kelsey took off from March Field for New York City, made one refueling stop en route and 7 hr. 43 min. later (actual flight time, 7 hr. 2 min.) crash-landed in a ravine bordering a golf course just short of Mitchel field, L. I. Fatigued by the long test hop, Kelsey reduced throttle too much when his approach overshot the field. Reapplying power, he choked the engines and had to put the plane down in the ravine. Though he was unhurt, the plane was a total washout.

However, as a result of Kelsey's enthusiastic reports, the Army authorized building 13 YP-38's. Major changes were included, such as upping military horsepower 170-h.p. per engine, designing the airplane for mass production, elimination of 1,300 pounds gross weight; revolving propellers outboard at the top instead of inboard, redesigning the armament compartment for a 37-mm. cannon to replace a Swedish-made 23-mm., and two of the four .50-cal. machine guns with .30's.

YP-38 engineering began in April, 1939; fabrication began in August. In February, 1940, assembly work on the first

(*Continued on page* 124)

Meet CAPTAIN POWERS

By FRED HAMLIN
Washington Editor of FLYING

A flyer at the age of three, this class-five ATC pilot has a background of achievement that is almost unbelievable.

EARLY in April—on the third, to be exact—I had the good fortune to meet and interview Capt. Roger Powers, one of the best-loved and least-publicized pilots of World War II.

The occasion was the captain's birthday and his co-pilot, Lieut. A. J. Buck of the Air Transport Command, had organized an impromptu celebration in the back room of a Washington fish joint down on the Potomac. By means which must be classified a "top secret," Powers had commandeered a jeep and he and Lieutenant Buck, aided by ATC mechanics at Washington National Airport, had overhauled it, adding cushions and gadgets to suit their special needs.

Driving to town from the airport, I tried to get a fill-in from Powers on the basic facts of his career but found him a tough one to interview. I thought the fact that he was concentrating on his driving—high-speed, despite 35-m.p.h. warning signs along the road—made him monosyllabic. But I discovered in the evening that he is habitually colorless and unassuming in conversation. This also matches his official record. That day he had completed three busy years with ATC but, on the books of the command, had logged only 1,000 hours—surprisingly low for an active pilot in this branch of the service. Like scores of other ATC flyers, he had seen service in the CBI theatre, in North Africa and, briefly, in ETO.

All these facts he gave me willingly, without elaboration. But whenever I got to questioning him about the more colorful aspects of his career, he would shut up like a clam.

An ample supply of beer at the fish joint failed to loosen his tongue and I had just about decided that the only way to find out anything was to get Lieutenant Buck to do the talking. Enroute back to the airport, however, I had the rare good fortune of eye-witnessing Powers in action. Although the incident took place on the ground, it typifies the man and the kind of activities that have made him an almost legendary figure in aviation.

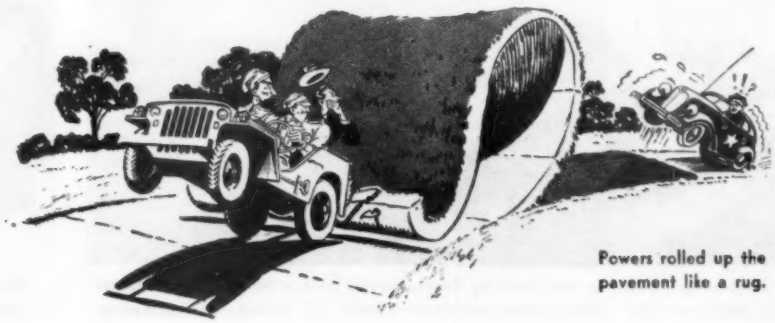
Halfway to the field, bouncing along at about 45, we were tailed by a police car. Powers paid no attention at first, intimating that we would shake it after crossing the bridge into Virginia, but the cops came on and began to gain. Powers took the pretzel turn onto the Mt. Vernon highway in high and stepped up to 55—still the cops pursued us. They were only about 200 yards behind us and gaining when Powers reached down to a small button on the dashboard and pressed it hard with his thumb.

There had been so many stories circulated about this special jeep job that I was ready for almost anything. I recalled that one of my more inebriate friends had told of a wild ride in it under similar circumstances. He swore that Powers had rigged an ingenious device beneath the jeep which—when dropped and hooked fast to the road—rolled the pavement up like a rug, leaving about 50 yards of unpaved road between the jeep and the cops that were chasing them.

Healthy skepticism is a good thing and even though my friend took me out for a look at the highway, where the 50-yard hole has since been replaced by a new strip of pavement, I'm still not convinced.

Actually no such thing happened on our cop-eluding spree in April. When Powers pressed the button on the jeep's dash, there was merely an increased sense of acceleration. Looking back I was amazed to discover that I was having my first ride in a jet-propelled jeep. What's more, the exhaust from the jet unit formed a huge green cloud of smoke from

(*Continued on page* 88)



Powers rolled up the pavement like a rug.

Air warfare was fast becoming a suicidal free-for-all until the Renshaw System gave our form-blind servicemen . . .

EYES THAT SEE

By PAUL FOUNTAIN

Associate Editor of FLYING

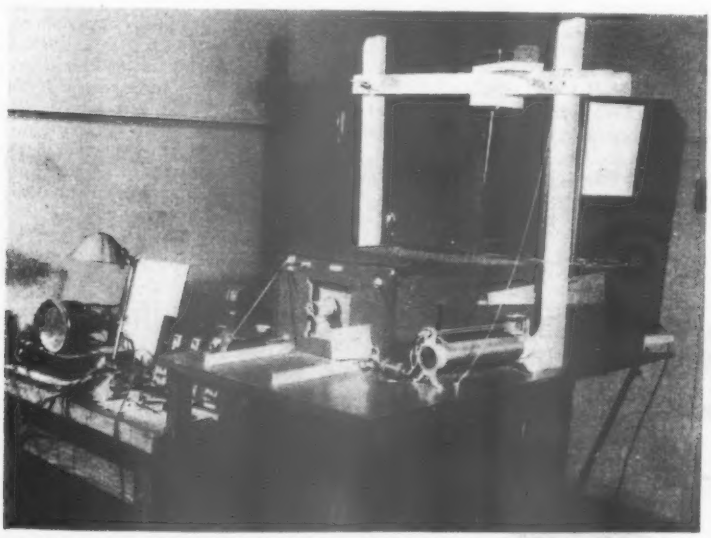
"EYES have they but they see not" is an ancient quotation that has assumed special significance in this age of flight. There are a lot of things untrained eyes do not see in this split-second world where speed of travel is fast approaching that of sound.

One of the most important requirements of air warfare is for men who can number and identify a skyscape full of aircraft in something less than one-fifth of a second. Untrained eyes just don't see that fast. That's about the time it takes you to wink your eye—it has taken you almost 10 seconds (if you are a fast reader) to complete this sentence. The blitzkrieg and Pearl Harbor demanded eyes that work 50 times that fast!

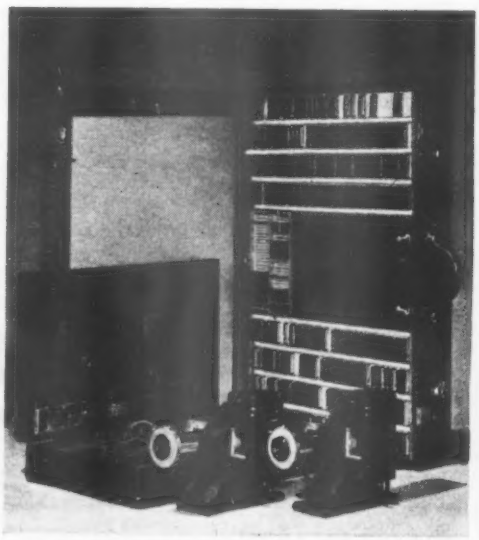
Sounds impossible? Yet, with the help of a few ingenious devices and the inspiration of an entirely new slant on visual training, our armed forces are today providing our men with speed of perception that does match the speed of this jet-propelled war. The devices and the new concept are pretty largely the result of work done by Dr. Samuel Renshaw, professor of experimental psychology at Ohio State University, Columbus, O.

In the three years since it was first

Dr. Samuel Renshaw, professor of experimental psychology, and one of the tachistoscopic projectors he uses to increase the speed of sight.



Original tachistoscopic unit, built by Renshaw years before the war. Trainees sat in booth at right. Chronometer at left timed the split-second training flashes.



Portable units (with extra projector, 2,000 slides) speed mass training in aircraft identification.

Untrained eyes require about 10 seconds to identify the 13 planes in this skyscape—eight Helldivers, three Lancasters, and two Avengers. Fighting men must do the trick in one-fifth of a second—must even note modified outline of one Avenger.

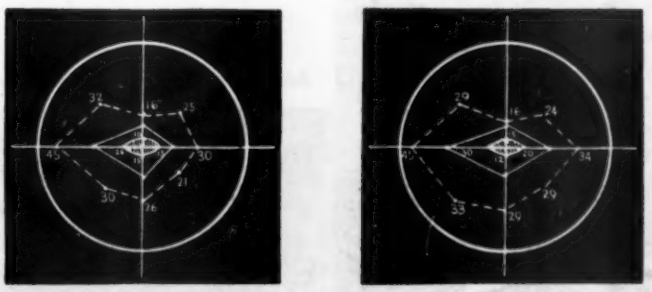
adopted by the Navy, the system of visual training prescribed by Dr. Renshaw and his associates has been adapted for use by all our armed forces, as well as by those of England, Canada and Australia. It has speeded Allied victory in war and promises to be a significant contribution to peacetime educational and commercial progress.

The story of the Renshaw identification training system—what it has done toward establishing Allied air superiority and what it will mean to aviation (and to innumerable other activities) in the future—is among the most intriguing of those service-on-the-home-front tales that have gone unnoticed in the midst of war.

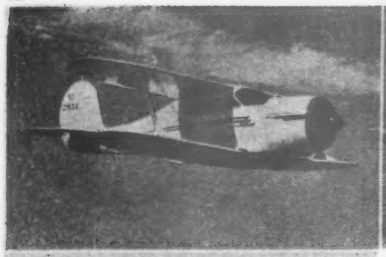
To begin with, the Renshaw identification system is not a war product. In reality it is almost 14 years old. It was back in the spring of '33 that Dr. Renshaw began the experiments which proved, for instance, that a student could be trained to identify a nine-digit-figure —963482571—flashed on a screen at only 1/100 of a second. Now, the untrained person can't even read a nine-digit-figure in 1/100 of a second—not to speak of memorizing it. The trick was done by flash—or tachistoscopic—training.

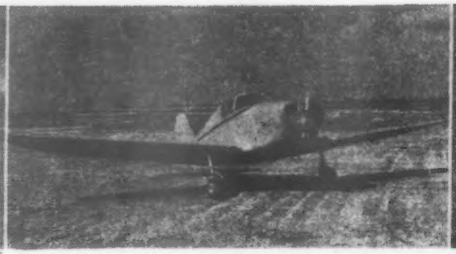
Using a home-made tachistoscope (a device which makes possible split-second projection of images on a screen), Dr. Renshaw also demonstrated that, by this tachistoscopic training, a person's visual form field could be vastly enlarged and that almost instantaneous perception of all items within this expanded field could be achieved. One of his subjects, for instance, achieved an increase in reading speed from 350 words a minute (a very high reading rate) to the almost unbelievable rate of 1,050 words per minute. That meant that perceptual areas of the subject's eyes had been expanded some 300 percent (see chart) after only 36 tachistoscopic training lessons.

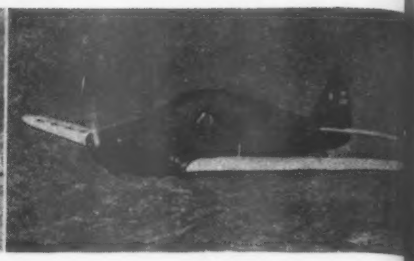
(*Continued on page* 132)



Expansion of visual form field for both eyes (dotted line) over normal area (solid line) achieved by a Renshaw trainee in only 36 tachistoscopic sessions.





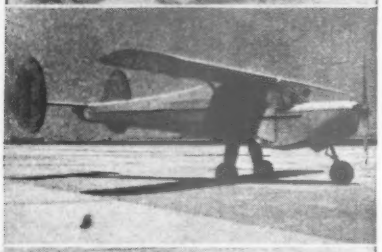


Upper left, Beechcraft D17. Above, Globe Swift Piper PT

Fairchild M-84

RETURN of the

By JOHN C. ROSS



Tennessee Skyfarer

Aviation Boosters, Inc., Skyhopper

"To all Aircraft and Aircraft Products Manufacturers:
"Gentlemen:
"War Production Board Order L-48, which heretofore controlled the production of civilian aircraft has been revoked as of this date."

THESE magic words leading off a letter from Henry P. Nelson, director, aircraft division, War Production Board, on May 17, started the first manufacture of personal planes permitted since the war began. To some manufacturers, filled up with orders for the armed services, it means nothing. To others with free plant capacity in areas where there is no labor shortage, the order is a small green light which is expected to grow brighter with each passing month.

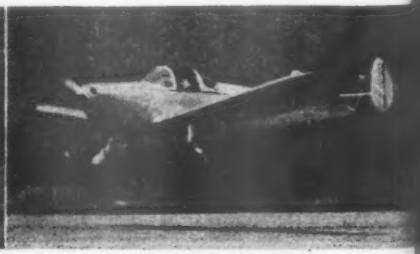
But to private pilots, who have been waiting for new planes for nearly four years, it is the beginning, perhaps, of a whole new flying age. For a few new planes will be coming off the lines before the ink on these pages is dry, and though the trickle will be small at first it will swell to increasing proportions as war requirements of men and materials taper off.

Because of the importance of WPB action, FLYING has asked actual and potential personal plane and engine manufacturers about the products they intend producing. Information on more than 40 companies is given in the following pages, including their present plans for immediate production, with information on the type of planes that

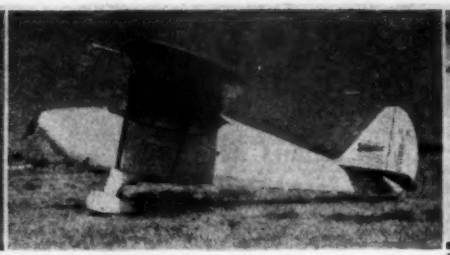
Stinson Voyager 125

Republic Seabee

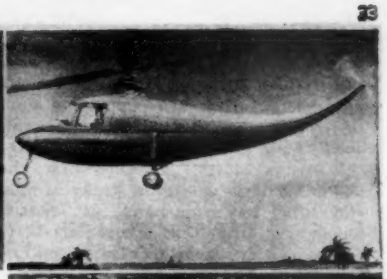
Below left, Taylorcraft 15. Below, Piper Super Cruiser Erco Ercoupe



Funk B-75-L



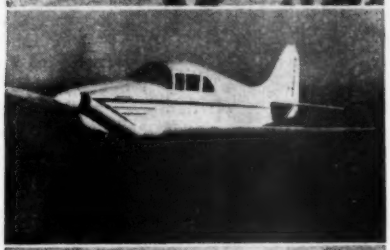
Hockaday Comet. Above right, Higgins helicopter



Aeronca Champion

PRIVATE PLANE

Government order permits civilian planes to be built for first time since war began.



Rocket 185

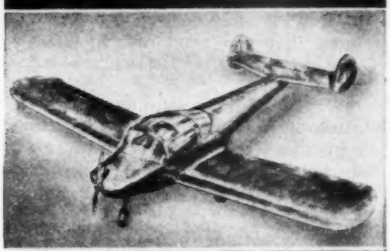
will first come out of the reconverted aircraft factories.

Many companies—especially on the West Coast and in other areas of manpower shortage—cannot yet even consider joining the trend to peacetime production. Even the other companies are likely to be so beset with materials shortages that their production will be but a fraction of what they plan—or could sell. But it is a start and, barring unforeseen military developments, the stream of new aircraft should grow steadily until two score or more companies are in full-scale production.

The summary which follows later in this article gives information on many new models. As generally anticipated, none of the first planes seems likely to be revolutionary. But information also is given on a number of projected models to be built later which may offer unusual performance advantages. The first planes off the lines, however, will be only improvements of the best prewar models.

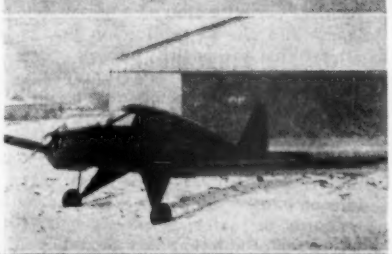
Before discussing them, however, let us look at what the repeal of L-48 actually means. Briefly, it permits any airplane or airplane engine manufacturer to build planes and/or engines for civilian use as long as such production doesn't interfere with military orders, and as long as materials are used in accordance with WPB regulations—which essentially means the same thing.

There are two categories of civilian planes: "civil transport aircraft" and "others." Manufacturers of civil transport aircraft which are certified as being a war-supporting activity, will be able to get priorities assistance if they



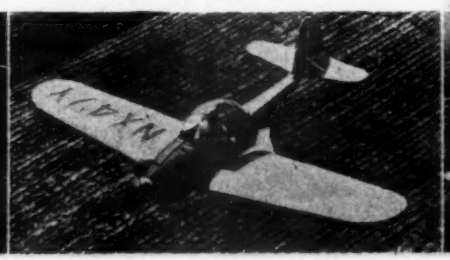
Aeronca Chum

Bell helicopter

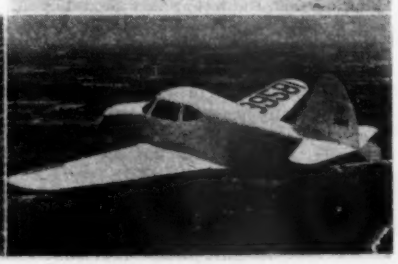


Call Aircraft Model A

Gazda Helicospeeder



Piper Skycycle. Below, right, Aeronca Arrow



cannot find needed materials without it. Manufacturers of most aircraft, however —including all lightplanes except those few demanded for war-supporting activities (such as crop dusting, for example) —will have to scramble for materials.

WPB takes the attitude that they should (1) use whatever stocks of materials they have on hand, (2) exercise "ingenuity" in getting new materials, (3) obtain priority assistance in exceptional cases.

The need for maintaining a supply of service parts for civilian aircraft is recognized, however, and the controlled materials will be allotted for this production.

The advice given to manufacturers by the aircraft industry indicates the difficulties in getting materials—at least at first. Here it is:

Scour around and get what surplus material you can. Co-operate with your local WPB office in this step, since it may be in a position to help you in locating surpluses.

Go to bat with normal peacetime suppliers, both warehouse jobbers and mills, in order to get a share of controlled materials from their surplus production (technically, through so-called "open-ended" plans).

When every bit of material has been scraped up from available surplus stocks and open-ended materials, go back to the local WPB and see if you can convince them that you need priority assistance provided by the emergency "spot authorization plan."

WPB's attitude definitely points to a continuing relaxation and revocation of regulations and controls on aircraft production. Plane builders will have to continue to compete with military and other civilian needs for material, but every time a control is revoked or removed that much more material becomes available in the civil market.

Revocation of L-48 introduced three new expressions used by WPB—"open-ended," "unrated orders" and "spot authorization."

"Open ended" controlled materials plan means that the manufacturer may produce any product that is not restricted by WPB orders. Orders for materials can be filled provided the supplier fills all orders bearing an allotment symbol first. The "open end" is the production that is left after filling the priority orders.

"Unrated orders" are simply those which cannot be accompanied by a rating or allotment (priority) symbol.

"Spot authorization" means priorities assistance given in special cases for those materials which cannot be procured from idle or excess stocks, in order that small amounts of materials necessary to fill a quota for production may be obtained.

For example, a manufacturer has plant capacity and manpower which might otherwise be idle. He has scoured the available sources of materials from "open ended" supplies and surpluses and yet he is still short some of the materials he needs. In this case the spot authorization procedure of the WPB could be invoked to avoid hardship as regards employment, etc. Of course, the manufacturer would have to be in a non-critical

(*Continued on page 78*)

While the preceding article summarizes plans of the private plane manufacturers, the editors here present a realistic dream . . .

FLYING's Airsedan

HUNDREDS of post-war lightplane "designs" have poured from the imaginations of artists. Some have had merit, but most are sheer flights of fancy, with little realism or practicality intended. Considering all the screwball "airplanes" being heaped on a gullible public every day, the editors of FLYING have thought it a worthwhile enterprise to collect as many aeronautical developments as feasible and incorporate them into an "ideal" lightplane. It seemed conceivable that an attractive, safe, economical post-war lightplane could be put together just through the use of already-existent equipment and devices?

Conceived more than a year ago by FLYING's editors, the results of the project can be seen on the gatefold facing this article. We have named it the *Airsedan*.

One cardinal rule governed the project from the beginning: nothing could go into the *Airsedan* that had not been actually used or proved out. Aside from that rule, however, anything could be considered. Although the *Airsedan* is a somewhat conventional design, it includes a number of ideas not found in the present-day private airplane. The Model T Ford throttle, for instance; the Jato cartridge for emergency take-offs, and so on.

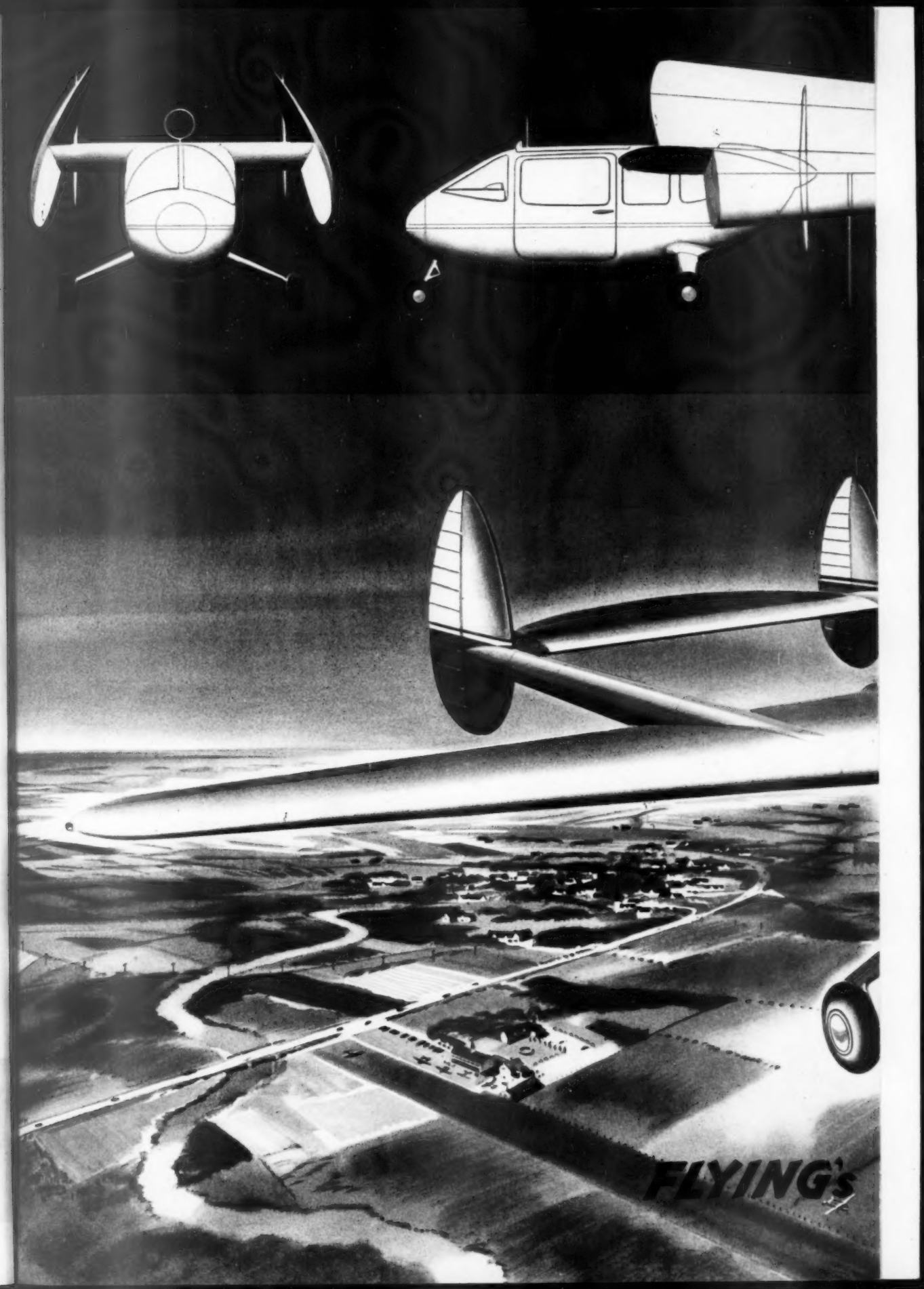
The basic idea behind the *Airsedan* was conceived by FLYING's editors, while the ultimate design is the result of months of work and consultation by the well-known aviation artist, Jo Kotula. A licensed pilot himself, Mr. Kotula seemed the ideal person to make something tangible out of the idea. Much of the technical research was his; many of the features in the finished design are his; the overall appearance of the *Airsedan* itself was conceived largely by him.

As is any airplane that ever will be designed, the *Airsedan* is a compromise. In the beginning, both Mr. Kotula and the editors suggested a wide variety of ideas: that it be roadable, that it be low- or shoulder-wing, that it be limited to two-place, that it be an amphibian, or helicopter. Then we began compromising. Finally certain basic requirements were agreed upon:

1. Every feature must have been proved somewhere.
2. High-wing, cantilever monoplane.
3. Pusher engine, guarded by twin tail booms.
4. Tricycle gear.
5. Two-control system.
6. Four-place.

The original conception of the project was that we would design a two-place landplane and a four-place amphibian. That plan ultimately was modified to include one alternate design in each of those categories: a four-place landplane and a two-

(*Continued on page 94*)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FLYING's

Airsedan

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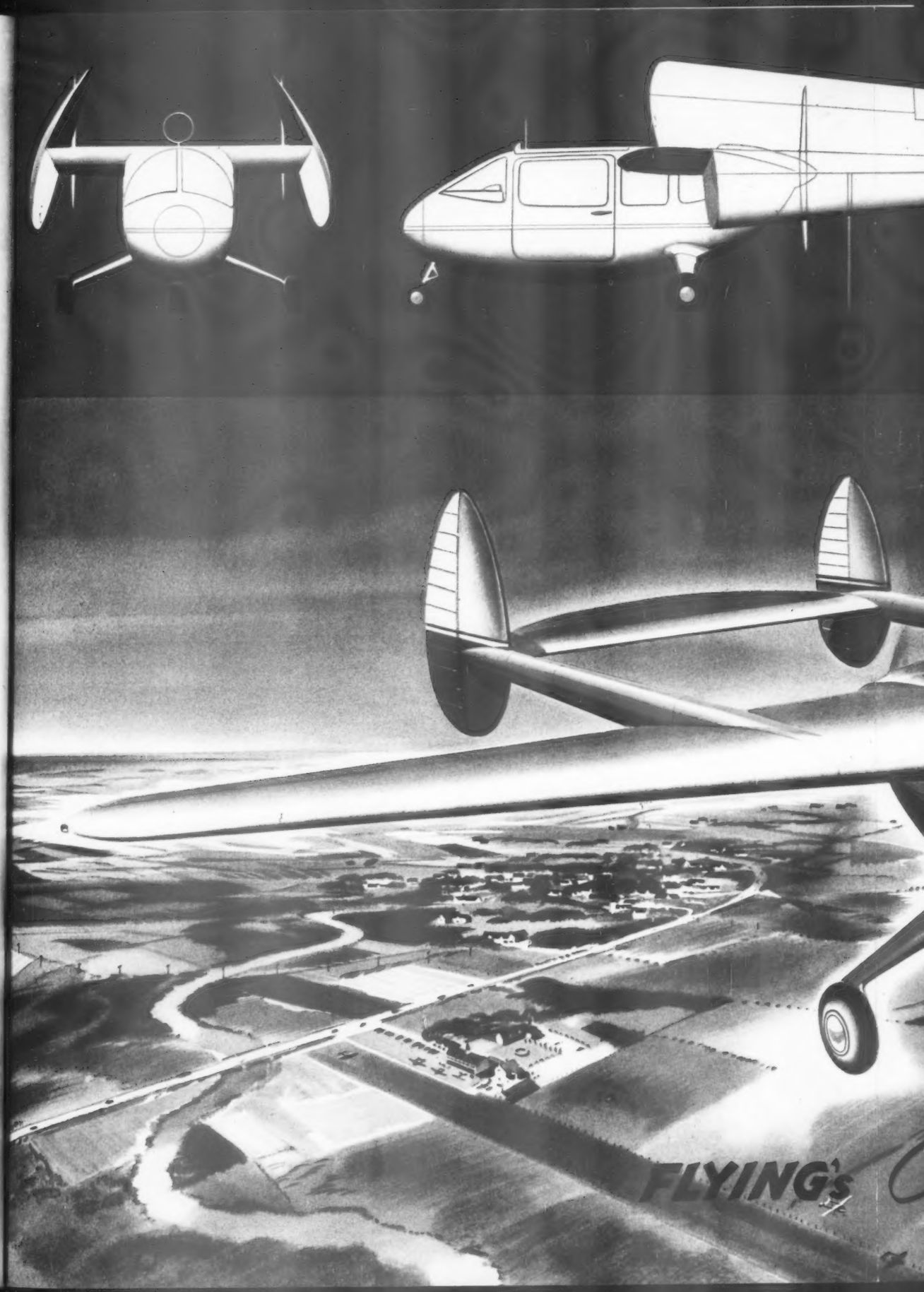
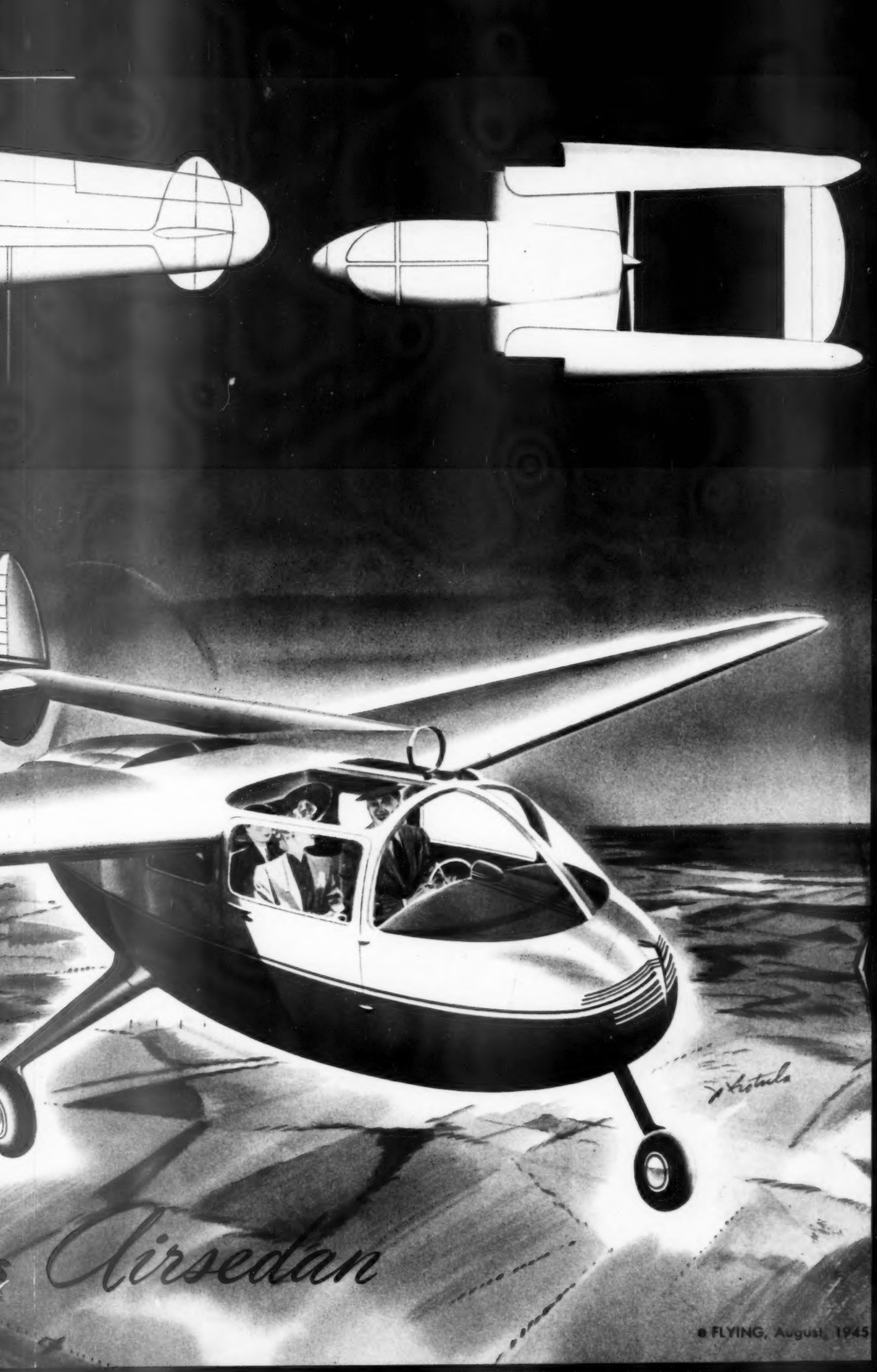



Airsedan

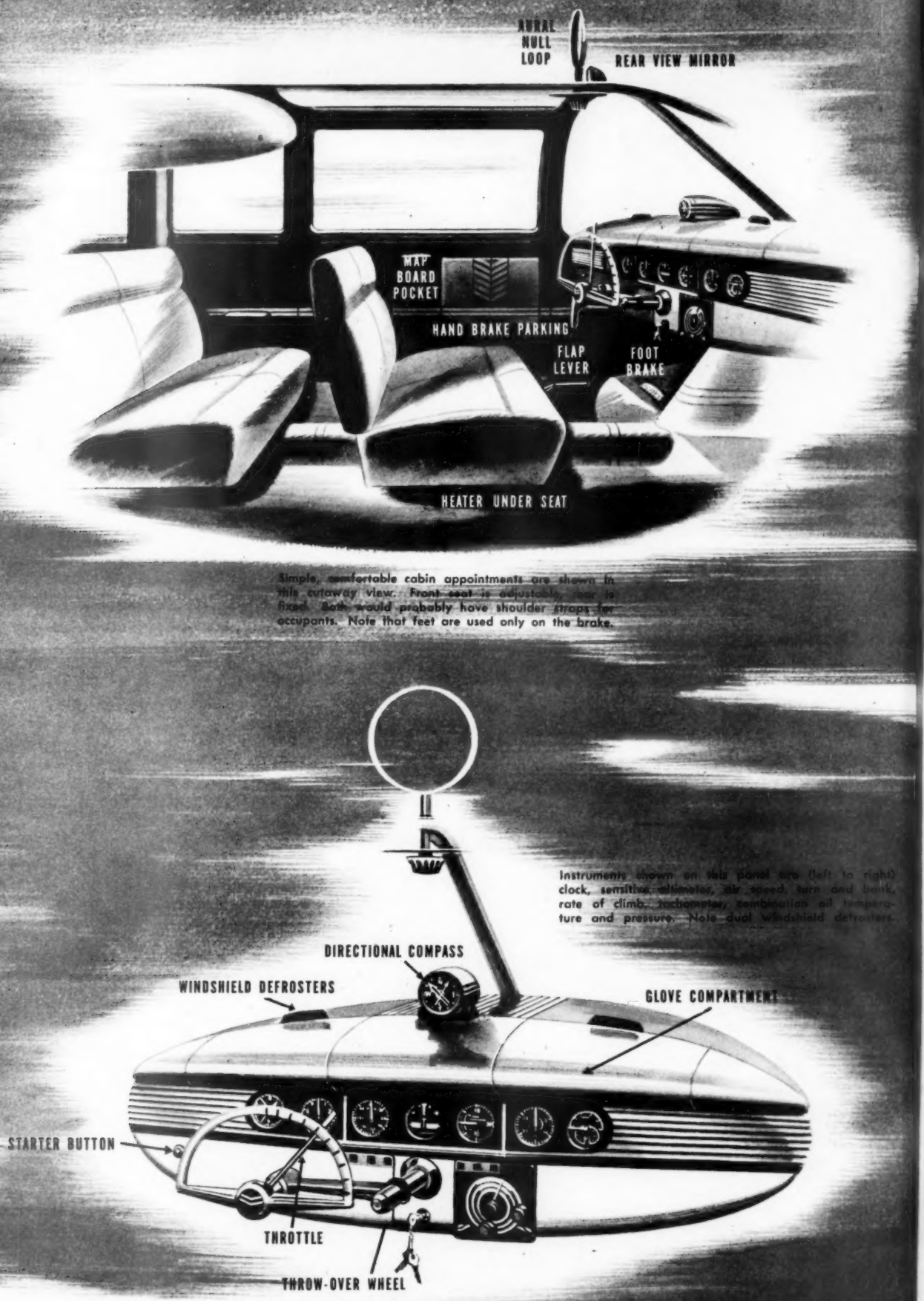
Two-place Airsedan would have 85 or 100 h.p., otherwise would closely resemble four-place version. This drawing shows lowered Grant-type flap. Ailerons are Van Zelm design, somewhat like those on the Marauder.

Airsedan FEATURES

EVERY effort has been made to design this airplane for amateurs — the sales-conditioned public that will take to the air in the coming years. The Airsedan was *not* designed for the expert pilot. It is intended to be a safe, reliable, economical mode of transportation that any competent automobile driver will be able to operate with a minimum of training. FLYING has leaned heavily on tastes created by the automobile industry, hoping that some day the Airsedan, or some modification of it, may be offered to an air-conscious public.

Airsedan's cabin is about same height as the average automobile. Pusher engine, protected by tail booms, should keep ground propeller accidents at a minimum. Twin Jato installation would be right below engine.

STARTER BUT



Simple, comfortable cabin appointments are shown in this cutaway view. Front seat is adjustable, rear is fixed. Both would probably have shoulder straps for occupants. Note that feet are used only on the brake.

Instruments shown on this panel are (left to right) clock, sensitive altimeter, air speed, turn and bank, rate of climb, tachometer, combination oil temperature and pressure. Note dual windshield defrosters.

BATTLE lines are drawn between the Aeronautical Chamber of Commerce and the Civil Aeronautics Administration over personal aircraft design and operating regulations. Developments in the squabble are being followed closely in the industry.

The controversy hinges on the CAA's Part 03 of the Civil Air Regulations, which proposes simplification of airworthiness requirements for non-transport types. ACCA contends the simplification recommendations actually add another "telephone book" to the CAA regulations and attempt to dictate the type of design that can be used for personal operation—a two-control, tricycle gear plane.

CAA labels the "telephone book" accusation ridiculous, denies any attempt to dictate design and counters with the flat statement that it is and always has been concerned only with safety and planes that will make flying easier, more popular. Major points of difference are: take-off speed and rate of climb vs. angle of climb, landing speed, stalling speed, and specification of flight characteristics. They also are at odds on such questions as spinning and the method of testing for turning flight stalls. ACCA agrees with CAA that the flat limit on take-off distance should be eliminated, but suggests substituting "angle of climb" for "rate of climb" on take-off. CAA calls for a take-off speed of at least 1.3 times stalling speed, while ACCA urges a speed equal to that of the best angle of climb—which, says CAA, would be appreciably less than the Government figure. The ACCA insists that specifying rates of climb makes personal aircraft ownership more expensive, as rates are raised from time to time to increase the level of safety, requiring successively higher-powered (more costly) engines.

CAA's position is that the level of skill needed to take a plane off the ground is high, that higher rates of climb therefore are absolutely necessary to provide a margin of safety. The high percentage of engine failures on take-off supports that argument, CAA points out. Since the pilot's primary concern in take-off is merely to clear an obstacle at the end of the field with a safe margin, says ACCA, the only things to be considered are take-off run and angle of climb. CAA's rate of climb regulation tends to rule out the low-powered airplanes, the Chamber added.

The new Part 03 drops the 65 m.p.h. landing speed requirement (long opposed by manufacturers) and permits a power-off approach at a steady speed equal to 1.3 times stalling speed. ACCA objects to any arbitrary landing speed restriction, asks that it give way to a provision for "measurement of the distance required to approach over a 50-foot obstacle and to land and reach a complete stop." That landing distance, plus the operating technique to obtain it, should be included in the certification sheet to guide the pilot, declares ACCA.

The 65-m.p.h. limit on minimum speed, long a part of the regulations, is retained but is applied to stalling speed rather than to landing speed. ACCA proposes to drop the limit on stalling speed and replace it with a figure determined during the plane's certification trials under CAA supervision. The stall speed thus obtained should be included in the operating manual or performance sheet. ACCA's major point on this question is that the maximum safe stalling speed depends upon the conditions under which the aircraft is operated—its controllability, glide control, braking power, ground stability, vision, type of fields from which flown and skill of the pilot.

On general flight characteristics, ACCA believes it advisable to specify such requirements as trim, stability, controllability, etc., in terms of the best angle of climb, since the angle varies with each airplane model. The speed at the best angle of climb, ACCA says, is more nearly the minimum safe speed for approach and climbing out than is an arbitrary speed based on the stall. CAA admits its proposed section on flight characteristics might entail a sharp increase in the amount of flight testing required for certification, leaves the ultimate decision to findings at hearings on CAR 03.

While there are clear-cut differences of opinion between ACCA and CAA on the technical merits of the Part 03 proposal, the Chamber is equally concerned right now with what it calls "the tendency toward the expansion of bureaucratic Governmental control" which adds "directly to the cost of the completed aircraft and simultaneously increases the cost of Government and the tax rate."

That theme is paramount in a six-page statement of ACCA's attitude toward the CAA proposals. It also permeates a letter from E. E. Wilson, ACCA president, to L. Welch Pogue, CAB chairman; and one from E. W. Norris, head of ACCA's airworthiness committee, to T. P. Wright, CAA administrator. The letters demand further review of Part 03 with an eye to omitting all items not essential to maintenance of minimum safety standards.

Cross-Wind Landing Gear

A fund of $150,000 has been earmarked by CAA to foster the development of a workable cross-wind landing gear for personal aircraft, but very little of it may be spent unless the industry abandons current research in that direction. CAA is prepared to sign contracts with any number of manufacturing companies doing experimental work on equipment to facilitate cross-wind landings and take-offs, and to provide technical assistance if it is required.

On the other hand, if the industry drops the project, CAA probably will take the initiative and request one company to join the Government in an exhaustive examination of the subject. Several companies, including Piper, Taylorcraft, Erco and Consolidated Vultee, are probing the possibilities offered by castering the wheels of lightplanes, but only one has publicized its findings.

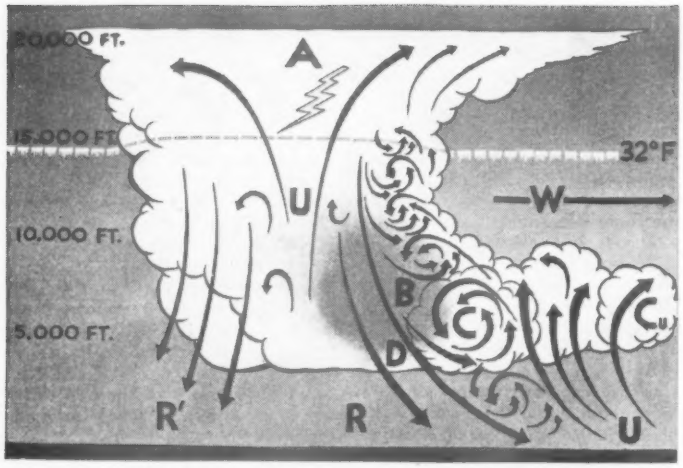
An article by one of that company's engineers described the experiments in detail, offering a favorable report which, however, carried an editor's note that the author's opinions were not necessarily those of the company he represented. Subsequently, the president of the company delivered an address in which cross-wind landing gear was dismissed on the ground that a sharp increase in airports after the war would obviate the necessity for such a gadget. CAA feels American research is moving in the right direction because it is devoted almost entirely to free-castering rather than to controllable wheels which have not proved too promising an avenue of development where they have been tried previously.

The English system, known as the McClaren undercarriage, is based upon the controllable wheel type of cross-wind gear. Using the English system (it has been tried on a *Mustang*, as well as on lightplanes), the pilot sets his main landing wheels at an angle dictated by the drift indicator on approaches. Cross-wind landings in winds as high as 60 m.p.h. were claimed in one British report, denied in another. CAA contends the McClaren arrangement is unsatisfactory since it is extremely difficult to determine the exact angle of drift because of shifting winds and changes in the speed of the airplane on the approach. Result, says CAA, is that wheels are not properly set and ground looping is almost inevitable. Computing drift and performing an extra operation (setting wheels at the right angle) further complicate flying for

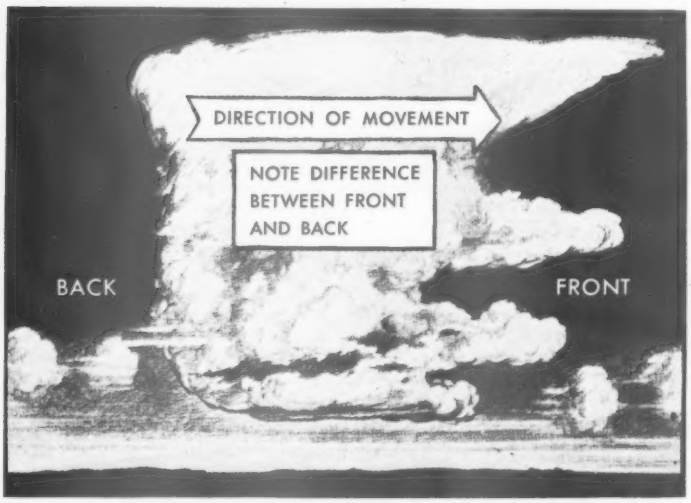
(*Continued on page* 130)

THUNDERSTORMS

Everything that is dangerous in weather can be found in a thunderstorm. To unwary pilots it spells danger.



(A) anvil top; (B) dark area; (C) roll area; (D) down drafts; (U) up drafts; (R) primary rain area; (R') secondary rain area and (W) wind direction.



The irregular, projecting cloud shelves point to the direction of a thunderstorm's movement. The rear portion of the storm has a smooth cloud pattern.

EDITOR'S NOTE

This article is a condensation of the Navy booklet "Thunderstorms," prepared by the Training Division, Bureau of Aeronautics. It is No. 2 in the Navy's aerology series which is being reprinted here because of its simple, lucid treatment of weather.

A THUNDERSTORM is a cumulus type cloud that has grown to unusual height. If it reaches beyond the freezing level, it may develop into a cumulonimbus cloud and a thunderstorm is likely.

Thunderstorms have four characteristics that identify them by sight and at a distance:

1. They are cumulus clouds with a distinctive cauliflower appearance along their sides.

2. They usually have spreading flat tops, resembling an anvil, which looks from underneath like a horizontal, solid deck of clouds jutting out in front of the main body of the cloud. This "anvil" leans in the direction of the upper wind which usually will be in the direction in which the storm is moving.

3. At the bottom of the violent thunderstorm cloud there usually appears what is called the "roll cloud," resembling a cylindrical roll of dirty cotton. It is formed by rising air currents in advance of the storm and downdrafts in the storm itself. Its presence indicates that the thunderstorm will be accompanied at the surface by strong gusts of wind. Absence of this roll cloud indicates the air currents in the storm are not severely violent or that the storm is in the dissipating stage.

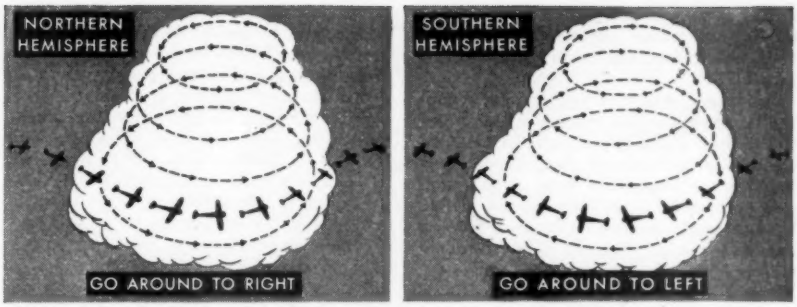
4. Within the storm and toward the

base is the "dark area," in many cases almost black, where the heaviest amount of rain is falling. This is the core of the storm. Low clouds may hide the roll cloud, the dark rain area and the base of the real storm. Shelves of non-violent cumulus clouds sometimes extend for many miles in front of a thunderstorm and these may hide the anvil top from a low-flying plane or its base from a high-flying plane.

On the leading edge of the storm, these cloud shelves are irregular, while on the rear of the thunderstorm cloud they are of a smoother pattern. Thus the appearance of the shelves indicates the direction of the storm's movement.

In the spring and fall of the year, when the icing level is relatively close to the earth's surface, tops of thunderstorm clouds are as low as 15,000 to 18,000 feet. Actually, such storms are not thunderstorms but showers and the formation generally lacks an anvil top and roll cloud. The cauliflower effect will extend to the top of the cloud with a veil of cirrus clouds around the dome.

Thunderstorm clouds may contain violent turbulence while they are still building, but updrafts and downdrafts are not of long duration. Lightning is uncommon in these storms and rain is light. Hailstones, when evident at all, are generally soft and small. Storms with low tops and no anvils can be flown through without too much difficulty if it is absolutely necessary. Thunderstorms that build up from 30,000 to 60,000 feet are a different matter. The height to which they build is governed by the distance from the earth's surface to the ice level. The greater this distance, the higher the clouds and the more violent the thunderstorm activity. These storms are common in the tropics during all seasons and in the middle and high latitudes during the summer season.



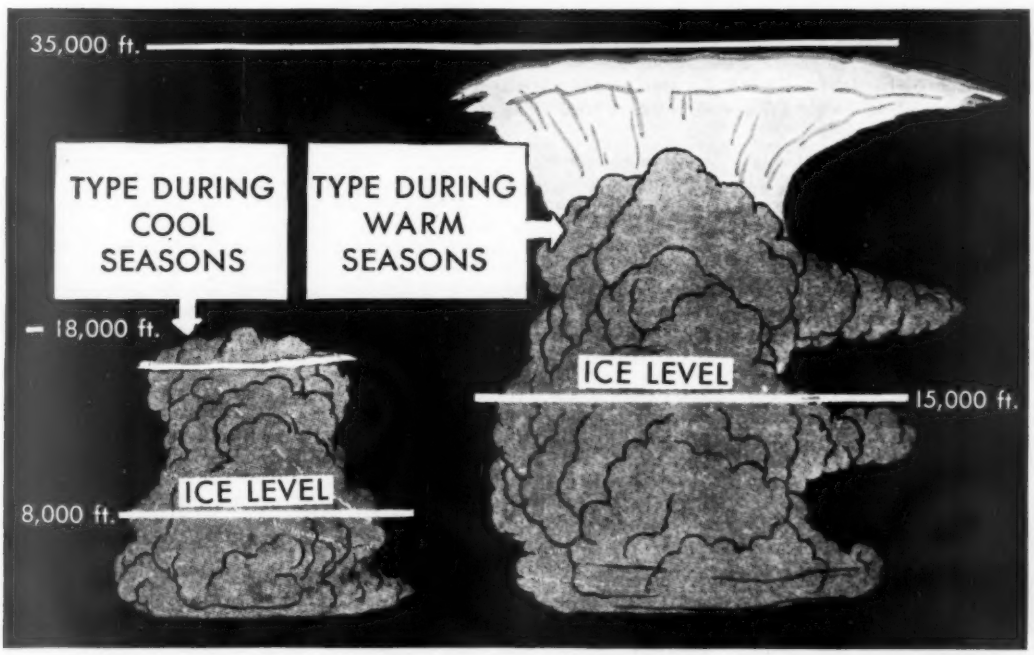
Going around thunderstorm to right in northern hemisphere and to left in southern hemisphere will give tail winds. Storm core rotation is counter-clockwise in north, clockwise in south.

Severe thunderstorms have cores which rotate counter-clockwise in the northern hemisphere and clockwise in the southern hemisphere. It is a sound policy to take advantage of whatever tail wind the circular rotation gives by going *around the storm toward the right* in the northern hemisphere and *to the left* in the southern hemisphere.

The towering masses of clouds contain ice mixed with rain and if their vertical air currents extend far enough beyond the freezing level you find hail. At night, lightning is usually the first warning of thunderstorms ahead. The region of the most frequent lightning flashes is ordinarily the most violent part of the storm. If you see more vertical than horizontal flashes, it indicates you are approaching the storm from the front where there is greater violence and, conversely, if there are more horizontal than vertical flashes, you are approaching the storm from the rear.

If horizontal lightning is the only kind you see, generally the storm is mild and its base well above the ground surface. This type of lightning is common with warm front thunderstorms and with the type of storm so common in the middle west, which begins to develop out of a clear sky after midnight. Thunderstorms at night present greater hazards than in daytime due to reduced visibility, but lightning will actually help you to fly them. Flashes reveal the height of the storm base above the surface; they illuminate the tops of the storm clouds; and many times they disclose the type of surface beneath the storm. Over rugged country this is especially helpful.

The fundamental thing required to form a thunderstorm is a strong upward current of air. When air rises it expands and thus cools. If it cools sufficiently, the moisture in it becomes visible in the form of clouds. If the vertical air currents are



Height of thunderstorm is determined by distance of icing level from earth. In cool seasons air is stable, in warm seasons unstable, thus lifted to greater altitudes. In the tropics, thunderstorms build to heights of 60,000 feet.

strong enough to carry these clouds up to an altitude where the temperatures are well below freezing, a thunderstorm is possible.

Air mass thunderstorms result when the sun heats a land surface which gives the "push" causing air particles next to the surface to rise and cool. Cooled sufficiently to cause the temperature and dew point to be equal they become visible to sight and, continuing to rise, form a cumulus cloud. Frontal type thunderstorms are of two general varieties: When a wedge of cold air moves into a region of warmer air, the cold air acts as an inclined plane, resulting in the warm air being forced upward, where it undergoes the process of cooling that causes thunderstorms called the "cold front type." Because the cold front slope is usually steep, the warm air is lifted suddenly and considerable violence results.

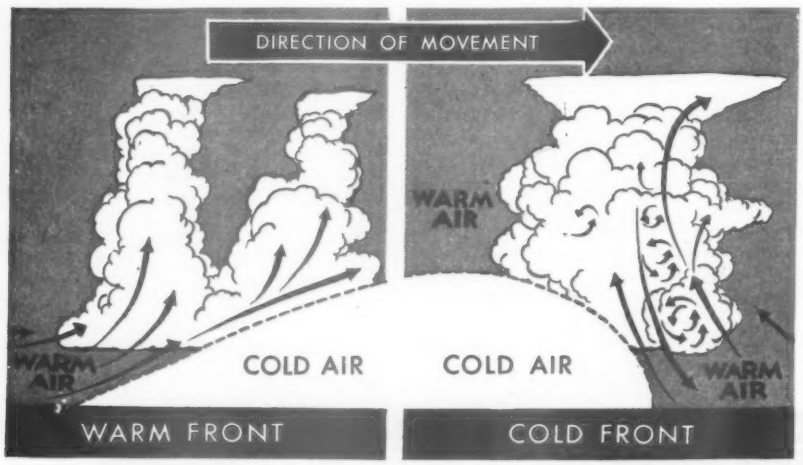
Thunderstorms formed in this way generally are concentrated in a zone about 15 to 50 miles wide, which may extend for hundreds of miles in length. Although the storm line may appear to be solid, it is really a series of individual thunderstorms closely compressed against other clouds without visible space between.

When a warm air mass moves into a region occupied by a cold air mass, the warm air will overrun the cold air and a similar rising and cooling of the air results. Resulting thunderstorms are called "warm front types." These form at higher altitudes with the cold front thunderstorm close to the ground and, as a rule, more violent. Below the warm front type is a shielding layer of cold air where little turbulence is to be expected. Warm front thunderstorms are scattered in the area ahead of the warm front.

Orographic thunderstorms result when air is forced up a hill or mountain slope. This type is frequent in mountainous country and along coastal areas where on-shore winds prevail. They may be isolated over one mountain peak or can be general along an entire mountain range. Usually storms of this nature are more violent than air mass thunderstorms and extend to greater heights. The orographic type forms on the windward side of mountains and hillsides where the updrafts bring about the formation of clouds. On the leeward side the air is descending and becoming warmer and therefore a pilot may expect to reach an area of decreasing turbulence after passing from the windward to the leeward side of hills or mountains.

Whenever you approach an area where thunderstorms are to be expected, fly either under the general cloud level so that you may recognize the base of the thunderstorms, or above the general cloud layers so that you can recognize the main body of tops of the storms. In dealing with cold front type it may be necessary to fly parallel to the front of the storm or some distance before making a decision as to how to fly it. When you finally make a decision it should be the right one and should not be changed thereafter.

If the terrain is flat or if over an open sea, the easiest way to negotiate a thunderstorm is to fly beneath it. If your fuel range is short and your service ceiling low, this is the only open method and unless you are sure you can fly beneath the storm, it would be better to leave it strictly alone and land safely at the nearest available airport.



Warm front thunderstorms (left) occur at higher altitudes and are less violent than the cold front types (right), in which the steeper slope causes rapid lifting of the warm air.

This underneath method, however, should not be attempted in mountainous country unless you are sure of your knowledge of the terrain and in no case unless you have from three to five miles visibility. If you can see enough daylight beyond the storm you will feel secure that once past the storm you won't run into another one that will spell dire trouble.

To avoid turbulence it is a good practice to fly at an altitude of approximately one-third the distance from the surface to the base of the storm. In addition to keeping you from getting too rough a ride, selection of this altitude will usually keep the updrafts from hoisting the plane up into the storm and putting you in real danger. You may encounter hail from the edges of the thundercloud front and sides. Its presence can be suspected by a greenish hue in the atmosphere that is unlike the dark blue or black that indicates rain. But before you decide to fly under a thunderstorm, make certain you can stay under—*all the way.*

If your equipment permits flying over the top of the thunderstorms or between the saddlebacks, it is preferable to any other method. Before deciding on this method you must be sure of your plane and equipment, sure of your knowledge of the storm and sure of yourself. This method is only for those with instrument flight ratings and for aircraft equipped for this type of navigation. The reason for this is that many storms will require going to an altitude of from 12,000 to 15,000 feet, requiring the use of oxygen, and often the saddlebacks are above the service ceiling of your aircraft.

Isolated air mass thunderstorms and orographic thunderstorms usually are local and whenever possible you should fly around them. The added mileage and time are usually of little consequence and prove well spent. When flying at intermediate levels it is essential to keep either blue sky or light spots in the clouds in sight ahead of you. This may cause you to alter course from time to time to miss the storm centers, although it is not advised to wander around too much if it can be avoided.

If luck is against you and you have no alternative but to fly through a thunderstorm, try to avoid the center of the storm area where the most violent turbulence is apparent from the "boiling" in the clouds. If you must go through, by all means avoid flying through the roll cloud. You can keep yourself from being blinded from lightning by lighting the cockpit or the instrument panel and keeping your eyes glued on your instruments. If your plane is equipped with retractable landing gear, lowering of this gear will reduce your speed and relieve the stress on the plane. If the gear is fixed, reduce your speed just as you would in other turbulent areas.

That is about all you can do—but remember this:

If you keep your head, your plane will outfly the storm.

Don't change your course.

Don't change your mind.

There are no fast rules that can be given to insure a safe flight through any and all types of storms. An unwary or indifferent pilot can find a thunderstorm a ruthless thing to deal with unless he or she has carefully studied storm characteristics. The general rules and advice presented here have been collected from experienced meteorologists and seasoned airline pilots. They all point out that the safest insurance that you, as a pilot, can have is confidence in your judgment, and knowledge of your plane's essential soundness.

If you want to avoid the turbulence of rough air, or hail that peppers your windshield, turn around and head for home in a hurry. However, if you *must* go through a thunderstorm, the only way to do it is—to go through. END

KICK THAT BALL

By WOLFGANG LANGEWIESCHE

Do you center that ball in the glass tube with rudder or aileron?

THAT little ball in the curved glass tube is the simplest of all aircraft instruments, and perhaps the only one that approaches perfection. It has no mechanical troubles, requires no connections, is without instrument error, needs no corrections, is not affected by temperature or altitude or ice or bugs or little boys who tamper with your cockpit—it always works. And it has another very good quality—it is direct. Many of the more complicated instruments use an indirect sort of approach; they merely hint. The altimeter measures altitude by measuring pressure; the air speed indicator measures air speed by measuring the pressure difference in the pitot tube; the tachometer and manifold pressure gauge merely allow you to guess at your power. But the glass-encased ball always gives you a direct, straight answer.

But you've got to ask it a direct, straight question. Don't call it a bank indicator and ask it about your degree of bank. The ball can stay in the center at any degree of bank and, if the airplane is correctly flown, it *will* stay in the center. In a sufficiently strong, fast airplane you can do a complete barrel roll, still keeping the ball centered. Often in flying the wrong word leads to the wrong idea—and the wrong idea leads to faulty flying. Therefore, don't call it a bank indicator or a ball-bank; call it simply "the ball."

What is the question the ball can answer? Some pilots think the ball shows whether one wing is *lower than it ought to be.* In straight flight, then, it would show whether one wing is low. Some pilots might add that in curving flight it would show whether the bank is too steep or too shallow "for the amount of turn." But this is asking the instrument a question it can't answer—moreover, one that may lead to confusion.

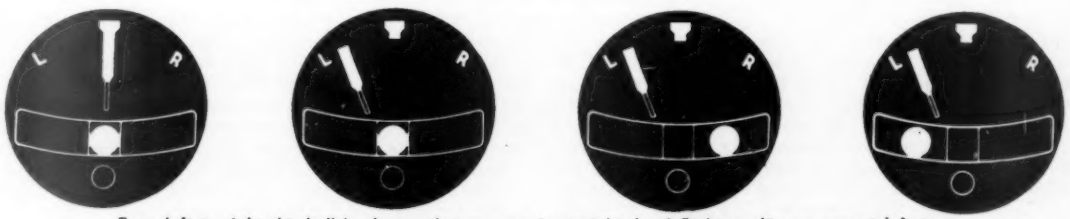
The ball can tell you only one thing: *whether you are slipping or skidding.* When the ball is off, it does not mean that one wing is low, but that the nose is pointing to one side or the other of the actual flight path. And the way to get the ball back to center is not to work the ailerons but, by rudder: *kick* that ball!

This is a basic proposition associated with the art of flying. It should be understood. First, consider what happens when the ball is off center during straight flight. Suppose the ball is off to the right. If you look at your wings you will find, true enough, that the right wing is down. But now, just to convince yourself, lift that wing with your ailerons while leaving your rudder pressures unchanged. What happens? The wing comes up but the nose now swerves off to the left and the ball is still off-center to the right.

It's what you should expect. If the airplane was at an angle of bank, to begin with, why didn't it turn? An airplane always wants to turn when banked—that's another of the basic principles of flying. Hence, if you were flying right wing low and did *not* turn, possibly it was because you were holding left rudder. Or, perhaps, it was because the spiralling of the propeller slipstream gave you the same effect as holding left rudder. Thus your right bank was trying to turn the airplane to the right while your left rudder was trying to swerve it to the left. When you level your wings, your rudder is still over and, with no force pulling the plane to the right it swerves to the left.

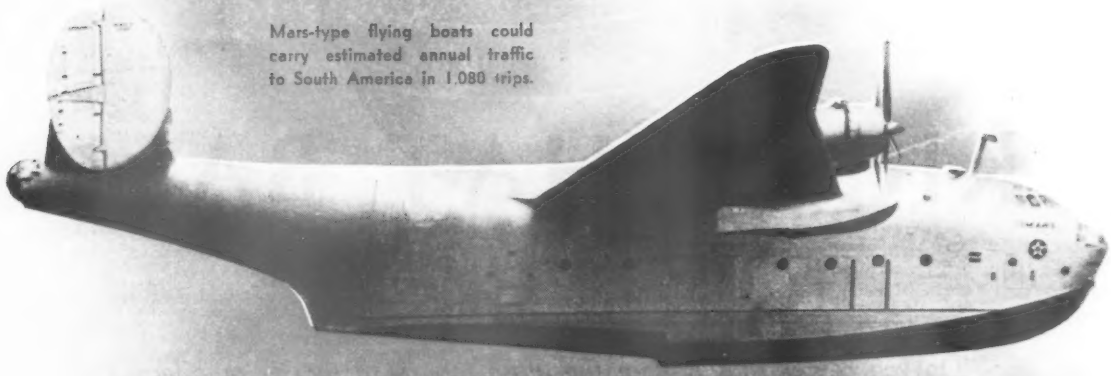
Now, just *kick* that ball. If the ball is on the right side, a little more pressure on the right pedal than on the left will roll the ball back to center. Here the airplane starts to turn to the right, for

(*Continued on page* 126)



From left to right this ball bank says that you are in straight, level flight; making a correct left turn; making a skidding left turn (too much left rudder), and a slipping left turn (not enough left rudder).

AIR TRADE *with the Americas*



Mars-type flying boats could carry estimated annual traffic to South America in 1,080 trips.

By JOHN B. CRANE

Chief, Transportation Unit, Bureau of Foreign and Domestic Commerce

Potential post-war air cargo between the United States and South America is estimated at 8,000 tons per year.

TREMENDOUS increase in air cargo between the United States and South America after the war is anticipated by the Bureau of Foreign and Domestic Commerce. No post-war fantasy, the expectation is based on recent studies analyzing commodity exports and imports for the year 1939 between the United States and each of the South American republics.

During 1939, Pan American Airways dispatched 217 tons of air express from this country to all of Latin America—including Central America as well as South America. This same airline predicts that in a typical post-war year, when new high-speed, four-engined equipment has been introduced and air cargo rates have been cut from an average of 93 cents to 25 cents per ton mile, the volume of air cargo to South America will reach approximately 5,000 tons annually.

The bureau's studies, on the other hand, indicate that of the total commodity exports to South America in 1939, nearly 60,000 air cargo tons represented potential export traffic, while approximately 17,000 air cargo tons represented import potentials. The value of potential exports approximated $50,000,000, and that of imports $9,000,000. In terms of value, these air-cargo potentials amounted to 10 per cent of the value of all trade, though in terms of weight they amounted to only a fraction of one per cent of all tonnage moving. These totals are for all of South America and were based on seven of the 10 South American Republics which accounted for over 89 per cent of total trade with this country. It has been assumed that the three remaining republics would show the same ratio of air cargo potential traffic to total traffic as the countries already analyzed.

In this article, the limitations of the bureau studies will be pointed out and revised air-cargo potential figures presented, based on certain new assumptions believed more nearly to approximate probable post-war traffic conditions.

The bureau, in its air-cargo analyses, defined as potential air traffic any commodity which had a value of 50 cents per pound or over, as well as all perishable, fragile, and style-factor commodities regardless of value. These commodities were sorted out because it was believed that they have much better prospects of going by air than others. The higher the value per pound, the more likely is shipment by air, other things being equal

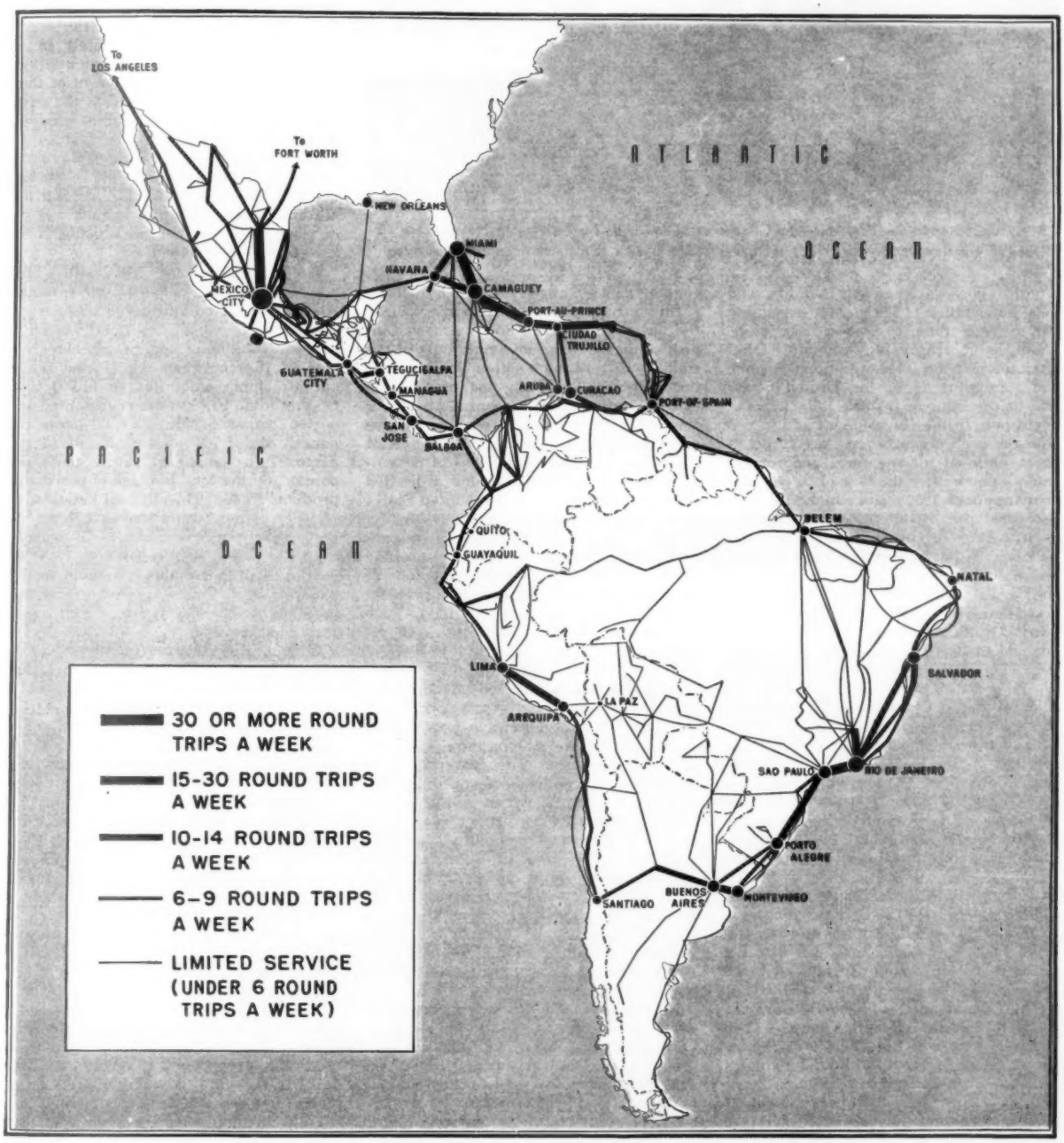
But if two commodities have the same value per pound, the commodity destined for a short haul to an adjacent country, 500 or 1,000 miles away, offers better prospects for air carriage than the same or a similarly valued commodity consigned to a more distant country. Certain commodities, for example, valued between 50 cents and $1 per pound, may offer good prospects for air carriage between the United States and Mexico or Guatemala but very poor prospects for air carriage to Argentina, Africa, or the Far East.

One unsolved problem is transportation charges. The answer will differ from commodity to commodity, but it is possible after study of specific products to sort commodities out and group them by their comparative ability to stand high charges. Among the factors enabling a commodity to stand high charges is its value per pound. In the United States, during the years prior to the war, railroad charges equaled about nine per cent of the value of all shipments, but the

range was from two per cent for some commodities to as high as 50 per cent or more in the case of other commodities. At the present time, based on the 1943 sample studies, it is estimated that air express charges on international shipments to South America approximate 25 per cent of the value of the shipments, while to certain other continents charges on the average equal 30 to 35 per cent of the value of all shipments.

It is believed that, with air cargo rates of approximately 20 to 25 cents per ton mile, post-war charges will not bear as high a ratio to the value of shipments as is true now. In the revised estimates of potential air-cargo traffic between this country and South America, which will be presented below, it has been assumed that air transport charges will average only 15 per cent of the value of all shipments. It has been assumed further that air-cargo rates will range from 15 to 25 cents per ton mile with an average rate of 20.5 cents per ton mile. Lower assumed rates have been levied against the more distant countries, and higher rates have been charged those countries lying closest to the United States. Finally, it has been found that all commodities worth 50 cents a pound and over do not constitute potential air traffic at rates of 20 cents per ton-mile but that the average value per pound of potential air cargo traffic to all South American countries should be $1.56. In the case of Ecuador and Venezuela, minimum values per pound of 63 cents and 78 cents were assigned as the proper starting points, while in the case of Argentina and Peru minimum values of $1.53 were used and for Uruguay, $1.70.

On the basis of the above assumptions, total potential air cargo traffic between the United States and South America for



This map shows frequency of commercial air service as of July, 1944. After the war, traffic is expected to increase.

Being loaded aboard a Pan American Clipper at Miami, Fla., for delivery to Havana, are 50 cases of cut flowers for use in observing All Saints Day, a Latin American religious event.

a typical post-war year was found to total 8,000 tons valued at $28.500,000—assuming 1939 foreign trade levels and 1939 prices.

But, is it reasonable to assume that after the war the level of national income and foreign trade of the United States will be the same as in 1939? Various experts, both in the Government and in private research organizations, are forecasting a national income level and foreign trade volume after the war of 50 per cent or more above 1939. If we make the conservative assumption that our foreign trade with South America after the war will run 25 per cent above that of 1939, and that the average value per pound of the goods traded will run 25 per cent above pre-war levels, then post-war potential traffic to South America would amount to 10,500 tons valued at $44,600,000. These figures represent, however, the potential and not necessarily the actual volume of goods that will go by air. If steamship lines should retain 50 per cent of the traffic, the amount which air carriers to South America would transport would total 5,000 tons valued at some $22,000,000. With air charges amounting to 15 per cent, air-cargo revenue to the carriers would approximate $3,300,000.

Unfortunately for post-war air carriers, the flow of trade between the United States and South America is highly unbalanced, with potential air-cargo exports amounting to some 7,000 tons and imports some 1,000 tons. This indicates that the volume of south-bound traffic will be seven times that of north-bound traffic.

The significance of the unbalanced loads lies in the effect on average load factors. Although high load factors may be attained on the southbound hauls, it will be difficult to attain reasonable loads coming back. In consequence, average load factors may not exceed 50 per cent on the round trip, whereas with balanced loads each way, a load factor of 75 per cent or greater might easily be realized.

An analysis of the destination of potential air-cargo traffic to South America indicates that the overwhelming bulk of the traffic will terminate either in Brazil or the countries bordering the north coast of the South American continent. Since this is the case, it might prove economically desirable to move the 5,000 tons of cargo and estimated 7,000 tons of passengers already predicted from a limited number of gateways in the United States to a limited number of gateways in the northern part of South America or Panama. Some indication of the magnitude of the problem of moving 12,000 tons of passengers and cargo annually between the areas mentioned can be gained by assuming the use of particular types of aircraft now in service.

Let us assume for example that the entire 12,000 tons is carried in the *Mars* operating through the New York, Miami, and New Orleans gateways to a similar number of gateways along the north coast of South America. The *Mars* has been flying Navy cargo loads of approximately 13 tons per trip between Alameda and Honolulu, over 2,400 miles non-stop. The post-war commercial version of the *Mars* will weigh 82½ tons gross and will be able to operate non-stop for 2,500 miles, carrying a payload of 16 tons. As a combination passenger-cargo plane, the *Mars*, fully equipped for a deluxe passenger service and with a crew of 14, can carry 72 sleeping passengers plus seven tons of mail and express.

In the assumed United States-South American service, if the *Mars* flying boats carried 60 passengers per trip and six tons of cargo, they could carry the 12,000 tons of passengers and cargo by making approximately 1,080 trips.

These results may be compared with the hypothetical use of DC-4 airplanes, based on data included in Pan American Airways exhibits, Docket No. 855, now being heard by the Civil Aeronautics Board. Pan American indicates a payload capacity for the DC-4 of approximately five tons for a range of 2,500 miles.

If we assume the DC-4 carries an average load of two tons of passengers and two tons of cargo, it would require over 3,000 trips annually or nine daily trips excluding Sundays. This would require nine airplanes in the air southbound and nine in the air northbound plus three spares, or a total of 21 planes.

Studies made by the Bureau of Foreign and Domestic Commerce on potential air-cargo traffic reveal that perishable products constitute a large percentage of total tonnage, but only a small percentage of the total value of the traffic. Perishable products constitute approximately 48 per cent of the weight of all potential air cargo, but only about 10 per cent of their value. In view of the fact that the overwhelming bulk of perishable products shows an exceedingly low value per pound, very few such products have any chance of being carried by air in the immediate post-war period. A second important factor militating against the air carriage of low-valued perishables is the long distances involved.

The prevalence of low values per pound in the field of perishable products may be illustrated by reference to the Republic of Colombia. The total weight of exported and imported perishable products in 1939 between the United States and Colombia amounted to 61,000 tons. Of this total, 52,000 tons represented imported bananas, valued at 1.3 cents per pound, and 8,760 tons consisted of exported lard valued at seven cents per pound. Of the total tonnage of perishable products traded, 99.7 per cent had a value of 10 cents per pound or less. Very few perishable products show a value of 50 cents per pound or over.

Studies of perishable products traded with the other South American republics, in general, show conditions similar to those just cited.

Commodities lying in the highest valued brackets offer the best prospects for air carriage, other things being equal; but shipments of such commodities are usually few in number and small in weight. In the case of Colombia, for example, there were 38 commodities traded with a value of $5 per pound or higher—weighing 25 tons—and 346 commodities with a value of 50 cents to $2, weighing 3,728 tons. In the case of Argentina, there were 56 commodities valued at $5 per pound or higher—weighing 31 tons—while there were 281 commodities with values ranging from 50 cents to $2 per pound, weighing 4,200 tons. Similar conditions held for the other South American republics.

In conclusion, for operating cost levels of 20 cents to 25 cents per ton-mile, a combination passenger-cargo plane service appears to offer the best profit prospects. Improvements in aircraft and operating techniques leading to operating costs of 10 cents per ton-mile, would lead to a tremendous increase in air traffic potentials and the desirability of exclusive air-cargo services. END

By Maj. OLIVER STEWART

British Authority, Editor of Aeronautics

ACCUSTOMED to living six weeks from starvation, England is acutely conscious that she must export or die. So there was approval for the setting up by the Society of British Aircraft Constructors of an export section with headquarters in London and branch offices abroad.

Under the executive control of E. C. Bowyer, the section will go all out to get world markets for British aviation products. Edward Bowyer, tall, thin, humorous, with an unusually retentive memory, is well-liked by newspapermen. Formerly air correspondent for London's *Daily News*, he left Fleet Street to become head of the Society's Information Department.

Chairman of the export section committee is F. G. Miles, go-ahead constructor responsible for the *Magister*, *Martlet* and *Messenger*. President of the whole society, which contains 37 ordinary members comprising all major aircraft and aero-engine makers in Britain, is Maj. H. R. Kilner, of Vickers-Armstrong, Ltd.

Commenting on the export section's prospects of success in competing with American aircraft makers, the *Economist* has this blinding glimpse of the obvious: "The extent to which Britain's aircraft manufacturers will be able to make use of their opportunities will depend largely on their ability to design efficient commercial aircraft as speedily as possible, and to market them at competitive prices."

Military Balance Sheet

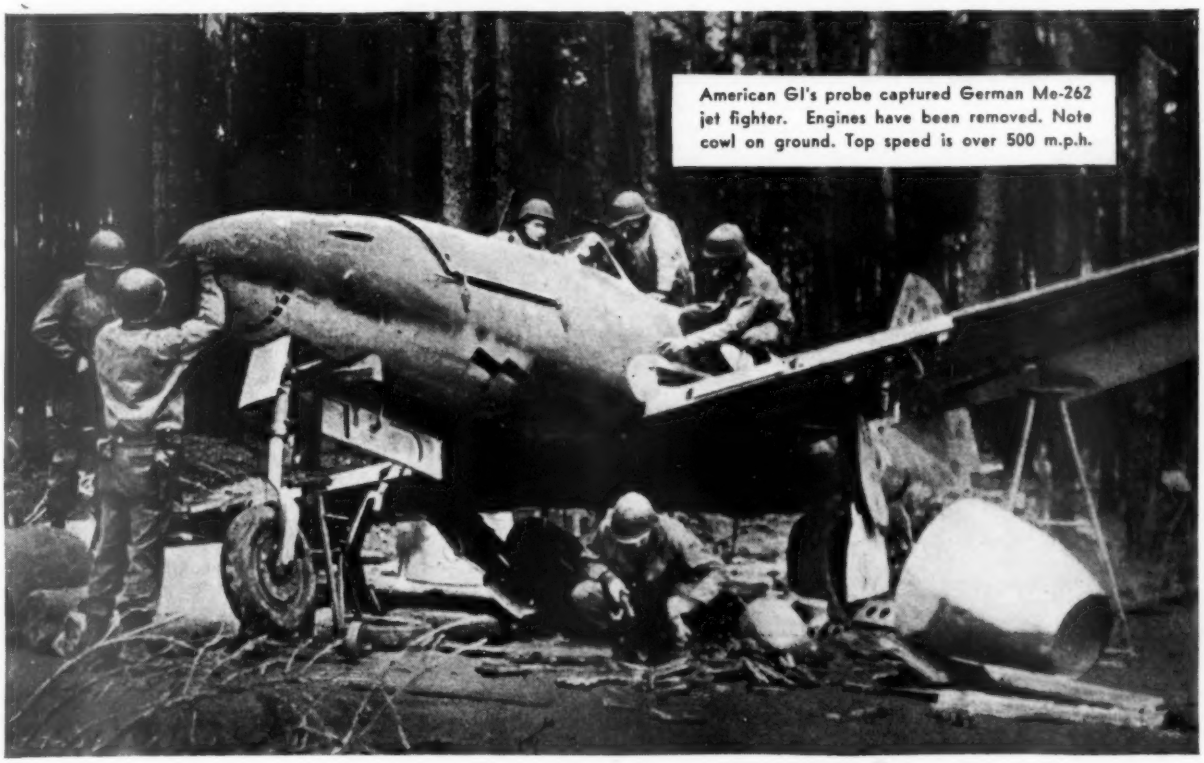
Wholesale tributes from Rundstedt, Kesselring and other German officers to Anglo-American airpower as the dominant factor in the defeat of Germany, did not turn the heads of the Royal Air Force and other technical specialists who had been studying captured German air material.

They could see how narrow had been the margin between victory and defeat in the air. If the British and the United States scientific and productive effort had been a fraction less the struggle might still be continuing. The question now is how much experience the Germans have passed to the Japanese.

Here are some features of German air equipment:

1. The jet-driven Arado Ar-234 bomber-reconnaissance aircraft is dynamically cleaner than the Messerschmitt Me-262. Its span is 47 ft. 3 in., length 41 ft. 9 in. The two underslung jet units are Jumo

(*Continued on page* 122)



American GI's probe captured German Me-262 jet fighter. Engines have been removed. Note cowl on ground. Top speed is over 500 m.p.h.

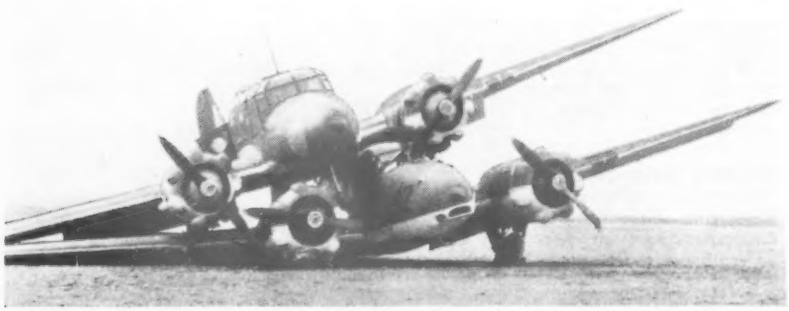
MID-AIR COLLISIONS

By EDWARD DOHERTY, Jr.

Application of a few common-sense rules will help prevent the 30-odd in-flight collisions each year.

POOR pilot judgment has been directly responsible for most of the 105 in-flight collisions of the past five years —and for the more than 50 deaths they have caused. A recent Civil Aeronautics Authority study covering such accidents shows that practically all mid-air crashes could be eliminated by pilot obedience of a few simple rules which can be summed up in the single word, "thoughtfulness."

For instance, there were the two civilian pilots—one flying a Luscombe *Silvaire*, the other an old Great Lakes trainer —who thoughtlessly set themselves to entertain onlookers with a mock dogfight. Witnesses reported that they flew close formation, diving on and circling each other at altitudes of no more than 1,500 feet. That their plane suddenly collided and spun in, killing both pilots, is only a natural consequence of neglecting basic safety rules. And the same description applies in the case of a half-hundred other pilots and passengers who died needlessly during the past five years, or so the CAA air-crash study would indicate.



These Avro Ansons, flown by student pilots at the RCAF school at McLeod, Alberta, collided in mid-air but made a safe and lucky pick-a-back landing. The pilots escaped uninjured.

The lightplanes shown here were about to land at the Van Nuys, Calif., airport. Neither pilot saw the other plane, and as a result they collided in mid-air. Three persons were injured.

Based on the CAA study, it is simple to set up a list of rules—adherence to which would do much toward freeing aviation of the mid-air collision. Here is one such list:

1. Always be on the lookout for other aircraft; avoid complacency—no air is free from traffic.
2. Never make abrupt turns when flying in traffic.
3. Know and obey traffic regulations at each airport you use. At unfamiliar ports, follow standard airport traffic patterns unless otherwise directed.
4. Leave fighter tactics to military planes and pilots.
5. Do no exhibition or formation flying except with properly equipped planes and skilled pilots.
6. When possible, avoid flying into the sun. When such flight cannot be avoided, wear sunglasses.
7. Know your plane's visibility areas and how to overcome its blind spots by proper "clearing" procedure.
8. Obey all Civil Air Regulations.

Contrary to popular belief, mid-air crashes do not occur when pilots have their minds centered on the immediate problems of flying and landing. Such accidents occur when a pilot forgets for a moment to exercise normal caution in performing a maneuver, or when his visibility is restricted—either by blind areas or by flying into the sun.

An accident caused by visual limitations occurred recently at a Naval air station. One Navy student flew his N3N to a normal practice area and began his practice routine. Another student in a Waco cut across the first student's practice area to reach his own. Flying directly into the sun, he was unable to see the N3N in front of him. In turn, the pilot of the N3N was unable to see the Waco because it crossed his course directly in line with his plane's blind area. Both pilots were killed in the ensuing crash. Both might be flying yet if the boy in the Waco had simply donned his sun glasses.

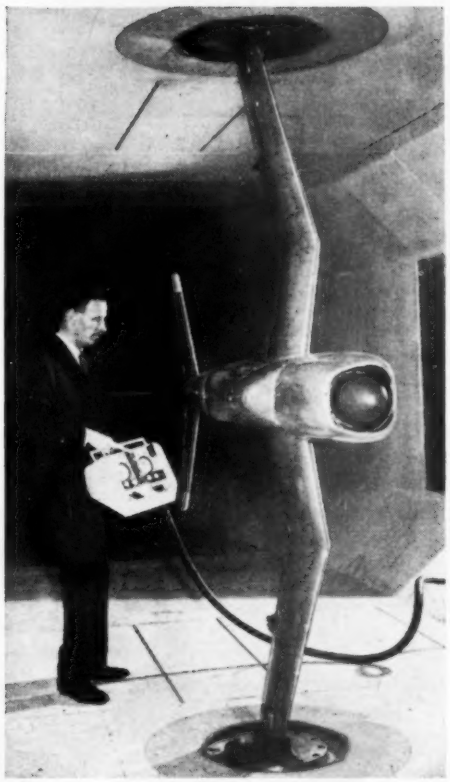
An abrupt turn caused another collision from which, fortunately, both pilots and planes escaped serious injury or damage. The pilot of one of the planes found himself too close to another plane. Instinctively he pulled abruptly away in a right climbing turn. The other pilot, seeing that this maneuver had sufficiently cleared the planes, continued the normal right turn he had already started. But the turn kept his plane in the blind area of the first plane whose pilot (trying frantically to find the plane he had avoided) made the mistake of doing an abrupt turn to the left—right into its flight path. Both pilots walked away from the crash, but their demolished planes evidenced what an ill-considered turn can do.

The fact that, in more than a third of

(*Continued on page* 98)

Have You Seen?

This 37-mm. anti-tank gun is mounted on a Junkers Ju-87 recently captured by U.S. troops. It has a similar gun under the left wing. Gun unit can be removed quickly.



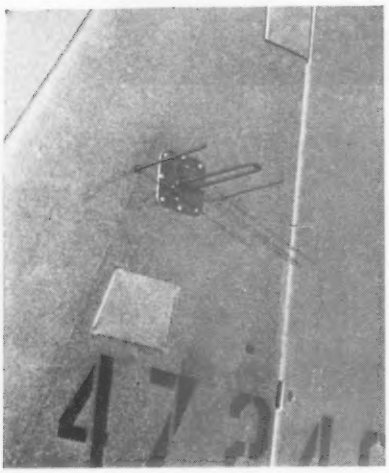
Model in Caltech wind tunnel is of Douglas XBTD-1 for Navy. Note gulled wing, bulge of rear turret.

U.S.-built Thunderbolt, captured and used by Germans, was found on Gottingen base by AAF officers, its guns loaded. Fuselage was olive drab, belly and tail yellow.

Grumman Tigercat is in combat with Marine Corps. Night fighter version (F7F-2N) shown here has small second cockpit for radarman behind pilot. Plane carries 4,000-pound bomb load or full-sized torpedo. It has four heavy guns in nose, tricycle gear, two 2,100-h.p. engines.

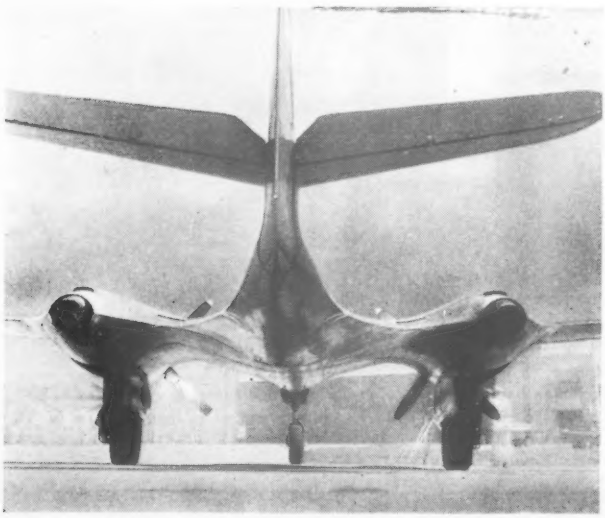
HAVE YOU SEEN?

CONTINUED



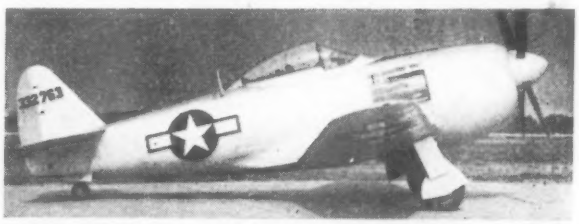
New radar antenna on tail of Mustang was on display at recent Los Angeles war bond show.

These Thunderbolts are carrying one belly fuel tank and two new fire bombs each. The bombs are dropped or skipped into the target from low altitude, spreading liquid fire.



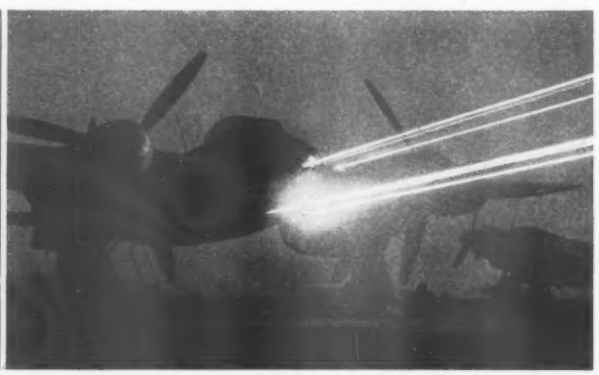
Tail view of McDonell XP-67 shows jet-effect tail pipes in nacelles of its two Continental engines. XP-67 project has been abandoned, was intended to test certain flying wing theories for long-range intercepters. Original armament was six 37-mm. cannon. Take-off runs were excessive.

Curtiss Seahawk (SC) is new Navy catapult seaplane for cruisers and battleships. It has nearly 1,200 h.p., carries only a pilot.

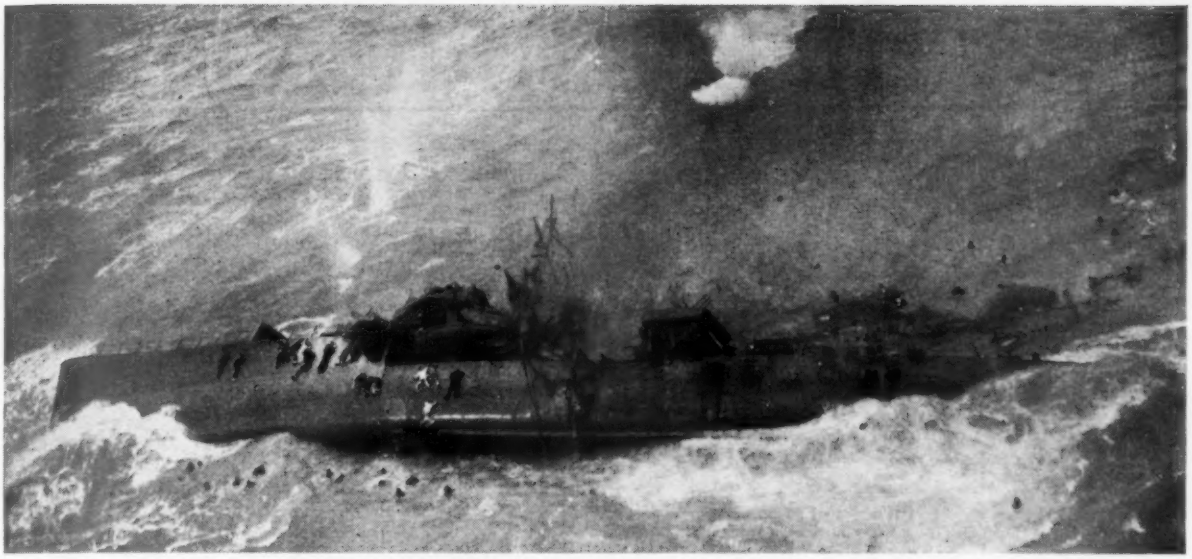


Curtiss YP-60E was experimental fighter with 2,000-h.p. engine. Span was 41 ft. 4 in., length, 34 feet. Top speed was 405 m.p.h.

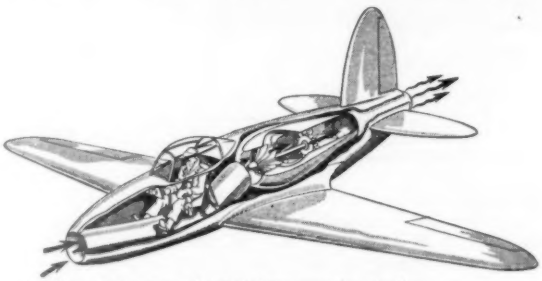
Night-firing test of Black Widow shows streams of tracers from its four .50-cal. machine guns (in top turret) and four 20-mm. cannon.



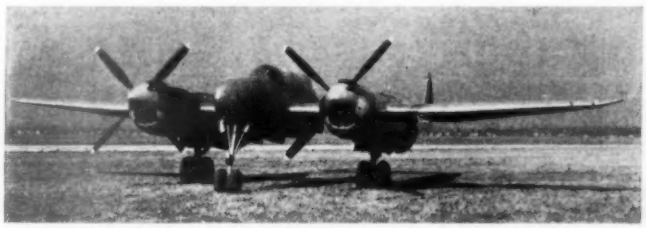
A Mosquito night fighter shows its fangs. The top tracers are from its four .303-cal. machine guns, lower ones from four 20-mm. cannon.



One of the best combat pictures to come from the Pacific shows a Jap destroyer escort sinking after a hit by Mitchells of the Air Apaches of the 5th Air Force. The ship's crew of over 80 was left in the water. Note bomb hitting water (top center) and splashes of bullets.

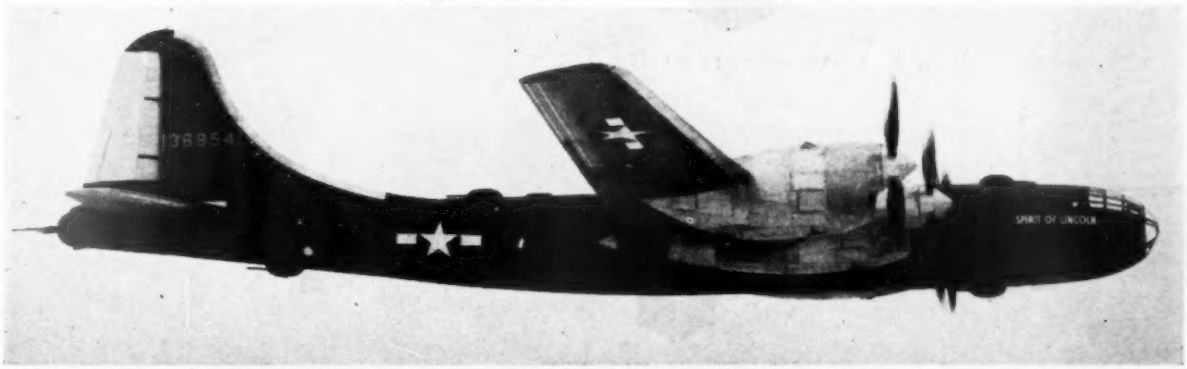


Lockheed drawing of jet fighter may be similar to appearance of Shooting Star (P-80). Notice great simplicity of design in such an aircraft.



Lockheed XP-58 had 2,600-h.p. Allisons, crew of two. Span was 70 feet, top speed 430, ceiling 38,000 feet. Armament: four .50's, four 37-mm. cannon.

White streaks in picture are smoke markers dropped from lead bombers to mark target. Others bomb on the markers.



Boeing XB-39 is an experimental B-29 with liquid-cooled Allison V-3420 engines, each of them over 2,600 h.p. Though not yet in production, this version proved to have excellent performance in Wright Field tests. This was the first B-29 built at Boeing-Wichita.

FOR IDENTIFICATION

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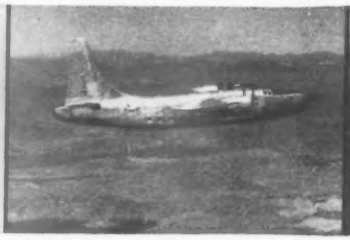

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The planes are: 1. Bell *Kingcobra* (P-63); 2. Curtiss *Commando* (C-46); 3. Consolidated RY-3; 4. Jap *Zeke* (formerly *Hamp*); 5. Consolidated *Catalina* (PBY-6A); 6. Jap *Judy*; 7. Boeing *Flying Fortress*; 8. Jap *Val*.

MISTAKEN IDENTITIES

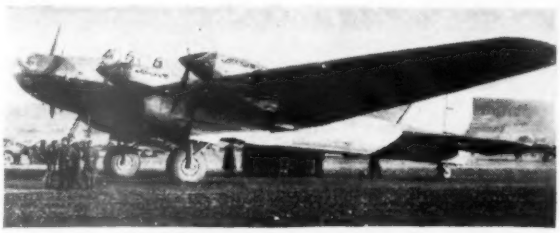
THESE two flying boats—one Allied and one Jap—may be mistaken for each other in the Pacific areas. They are the British Short *Sunderland* and the Jap *Emily*. While they are strikingly similar, the *Emily* has 12 feet greater span, as can be seen in the two front views below, to exact scale. Other views of these two types will be shown in later issues. Note that *Emily's* engines are relatively closer to the hull than are those of the *Sunderland*. Also the wing tip floats of the British flying boat are braced.

Short Sunderland wing span: 112 ft. 9 in.

Emily wing span: 124 ft. 7 in.

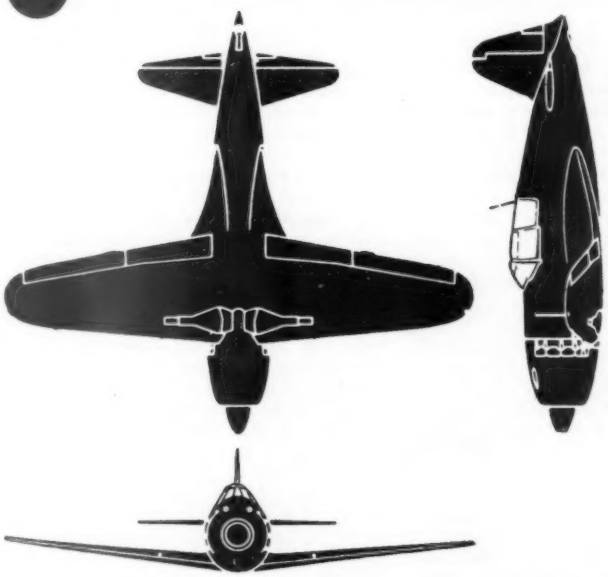
NORTH AMERICAN MUSTANG

This is the version of the *Mustang* currently in combat, the P-51D. Generally, it follows the lines of its older brothers, but now is powered with a 1,525-h.p. Packard *Merlin* engine, giving it a top speed of more than 450 m.p.h. and cruising speed of 266 m.p.h. It stalls at 102 m.p.h. Wing span is 37 feet, length, 32 ft. 2 in.; height, 13 ft. 8 in. Gross weight is 8,525 pounds, weight empty, 7,096 pounds. Range is over 2,000 miles, service ceiling over 40,000 feet. Armament includes six .50-cal. machine guns, 10 five-inch rockets and two 500-pound bombs. P-51D's are escorting B-29's over Japan.



TUPOLEV TB-7

One of Russia's few heavy bombers, the TB-7 also is an old-timer. It is powered with four liquid-cooled AM-38 engines of 1,300 h.p. each. Wing span is 131 ft. 3 in., length is 80 ft. 6 in. Top speed is reported to be 280 m.p.h. at 25,000 feet, range 2,500 miles. It carries a crew of 11 and a gross weight of 49,280 pounds. Bomb load is up to four tons.



JACK

Japanese name for this fighter is the Mitsubishi Raiden (which means Thunderbolt). It is a tiny, short-range fighter and is reported to weigh only 7,000 pounds gross. Wing span is 35 ft. 5 in., length, 31 ft. 10 in. It is powered with an air-cooled Kasei 23 engine and is reported to be able to climb to 20,000 feet in 5½ minutes. Armament appears to be two cannon and two machine guns. U. S. pilots have met it in the Philippines.

NEWS NOTES

As this issue went to press the Navy had just released information on the Curtiss *Seahawk* (SC). It is a single-seat scout, but looks very much like a fighter, somewhat resembling the old Curtiss P-36 . . . Data on the Grumman *Tigercat* (F7F) was released earlier than the Navy wanted due to the inadvertent slip of an eastern newspaper . . . There is an all-black, radar-equipped version of the Lockheed *Lightning* now being used in the Pacific as a night fighter . . .

I Learned About Flying From That!—No. 70

The author, who piled up more than 20 round trips across the North Atlantic as ferry pilot

By C. TRUMBULL, Jr.
Former pilot, RAF Transport Command

Even a seat cushion—or lack of one—can cause a crash.

DON'T neglect the little things! That's what my one crack-up taught me. If there's something about a plane you know is wrong, have it fixed; if it's a minor fault and you're in a hurry you can sometimes talk yourself into thinking it won't really matter. That's a great mistake.

This all happened while I was ferrying planes for the Air Transport Auxiliary in England and at that time airplanes were worth their weight in gold. This fact made me feel especially bad about breaking one up. The third plane I had to ferry was a Curtiss *Mohawk*, similar to the old Army P-36A. Right up to the firewall it was like a *Warhawk* but instead of an Allison engine it was fitted with a Pratt & Whitney.

After being dumped from our taxiplane onto a muddy dispersal field I began an endless wandering around through the mud signing papers and trying to find my plane. This procedure always seemed necessary and with a heavy chute and over-night kit dragging one down it gets very monotonous. When I did locate the plane I found it would be two hours before it was ready and I spent this time going over the job.

A test pilot gave me some dope on performance, flying characteristics, and the condition of the so-called aerodrome they were using. The field was a little patch of mud that was being used till the main airfield, now called Colerne, was built. About 1,000 feet of mud, terminating in a gap about 200 feet wide between a woods and hangar, was the runway. It was November and cold, real English cold that goes right through you, and there was no heat during my two and a half-hour wait. I was tired, cold and muddy by the time the crate was ready to roll and I was not in a very patient mood.

Once seated in a very roomy cockpit I found that with my belt on I couldn't reach the rudder pedals properly and asked for a back cushion. Later someone told me, whether true I don't know, that these planes were built for a back 'chute. I can believe this because it was a tremendous distance to the rudder pedals. This batch of planes had been built for the French and when France folded up they were diverted to the British. As a matter of fact they still had all French instruments in them.

It was getting pretty late when a member of the ground crew returned without finding a cushion. If I delayed much longer I would either be flying around unfamiliar country in the dusk or have to stay in the nearest town, Bristol, overnight. So I fired up the P. & W. and taxiied out into the mud. The strip looked mighty short and the gap at the far end pretty narrow but other planes got out O.K. so I guessed I could too.

But when the throttle was about half open and I was fairly well on my way, the plane developed a swing. Without a cushion and with the rudder pedals too far away for me to use full rudder, I couldn't get the craft straightened out until I had built up considerable speed. I could see the trees at the end of the runway approaching rapidly—far too rapidly to suit me.

There wasn't much time to make up my mind what to do. In fact there was no alternative. The field was so short I couldn't cut the throttle and stop in the remaining distance without hitting a hangar. So I slammed the throttle wide, running the boost gauge off the clock, and had to pull the plane off and start climbing at once to clear the large clump of trees in my path. The gear was just starting to retract when the first tree flashed under my wing.

I thought I'd cleared them but in the next instant it happened. With a crash that *Mohawk* lurched right through a big oak, the prop chopping its way clear, and although it seemed to falter a second we kept flying. One piece of wood about as big as my forearm stuck through the windscreen and lodged there. The plane began vibrating because of a bent prop. The landing gear jammed in a half up position. I could see that the leading edge of my wings were smashed in so I proceeded to get plenty of speed before cutting back on power and revs.

The plane seemed to be flying well enough but I knew I wanted to get back on the ground as soon as possible. I circled the mud patch aerodrome and could see a meat wagon and fire truck drive out, then I began seeing what could be done about getting the gear unstuck. It wouldn't move under normal operation so I began making shallow dives and sharp pull-outs. Each time I did this the gear moved a bit and finally, after 25 minutes, it showed down and locked. My belt was tightened and I made my approach with plenty of speed so there would be no danger of those battered wings stalling out. We hit the mud in a three-point and rolled to a rather quick stop. Much to my amazement that twisted gear held. I taxiied back to the group that had collected and climbed out sheepishly.

After determining that I wasn't hurt, the engineering officer and I had a look at the wreckage. The engine cowl was shoved back into the cylinders, the leading edges were dented and torn their full length, all prop blades were bent, all the fairing was stripped from the landing gear legs and the legs themselves were twisted, and several holes were punched in the belly and tail group of the battered aircraft.

In most any plane but a *Mohawk* I would really have piled up, perhaps fatally, and all because I'd gone off knowing something was not right. If I'd had that cushion none of the mess would have happened. So I stayed in Bristol after all and it was the night the Jerries first pounded that city—the worst of several raids I'd been in. Thus, just because I was impatient, the following things resulted: I nearly killed myself; I cracked up a brand new plane; I wasted two days flying; and I nearly got bumped off in an air-raid.

I learned about flying from that! END

Buying THAT USED PLANE

These WTS planes and Army liaison and primary craft are among the varied types of surplus planes now being sold to private pilots.

By
J. LLEWELLYN CLARK
Aircraft Maintenance Engineer

Nearly every used plane has something wrong with it. Here's how to locate its faults.

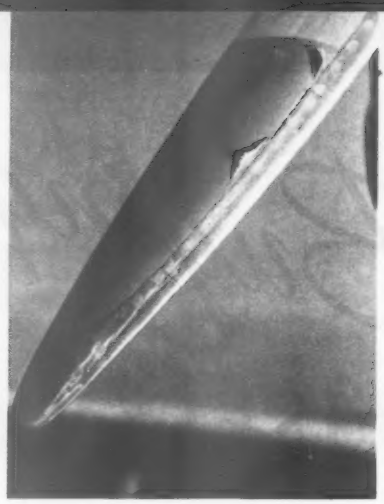
AIRCRAFT available for civilian markets today rolled from the assembly line several years ago. Since that time, most of these aircraft have endured strenuous pilot training programs during which maintenance standards have, in many cases, been low due to unavailability of replacement parts, a dearth of competent mechanics and the pressure to keep the aircraft flying.

Aircraft files reveal that the majority of these planes have flown more hours each month than a great many privately-owned planes would fly in a year. These flying hours have not been easy on equipment. Instruction requires a steady grind of co-ordination exercises, spins, practice landings, etc., at the hands of inexperienced operators. A great number of these aircraft have been ground-looped or involved in more serious accidents; few, if any, have emerged without having been stressed excessively in some vital component. Many have fuselages out of alignment, bolt holes elongated, spars weathered, fabric deteriorated.

It is true that some of these planes have been purchased, rebuilt and placed on the market for resale. If an honest job of repair has been accomplished and they have been inspected and approved by an *aircraft inspector*, General Inspection, CAA, you may well expect good service from them. But it is also true that many trusting purchasers of used aircraft are being hornswoggled today by unscrupulous vendors of potential accidents in the form of planes which have had the fabric rejuvenated and have been patched up to appear airworthy to an unsuspecting purchaser.

If you contemplate the purchase of a used aircraft, be guided by the timeworn saying, "Make haste slowly." Don't buy until you have inspected. A great many

Excessive rust on this PT-17's brake drum and landing gear can seriously weaken the undercarriage.

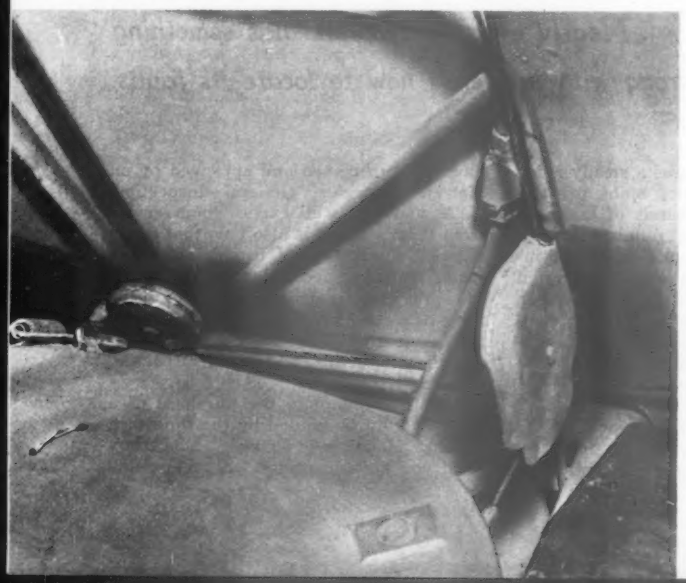


Fabric facing of propeller should not be torn as shown. Check the metal tipping for cracks, dents, loose rivets.

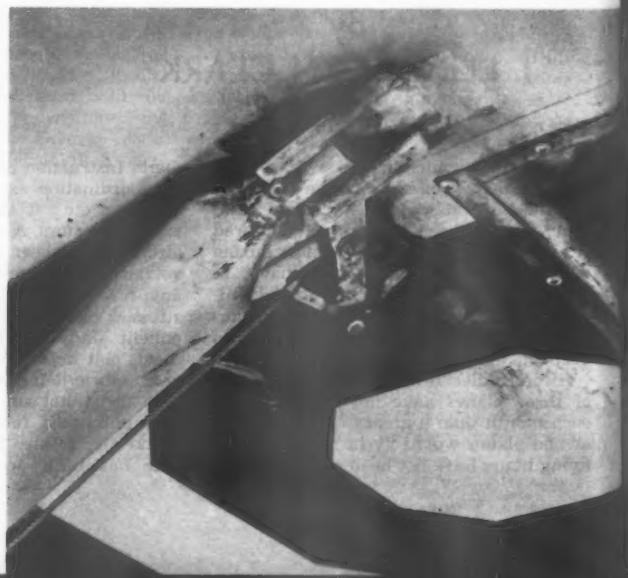
The paint on this BT-13's wood fuselage is badly cracked. On a fabric plane, deterioration would be shown by cracks, from which paint could be peeled off in strips.

Test resiliency of fabric by pressing on it with fingers (left). It should return to original shape in a few minutes, but if depression remains (right), cut out a patch and crease it. A poor rejuvenation job has been done if outer dope layer will peel away from under layers.

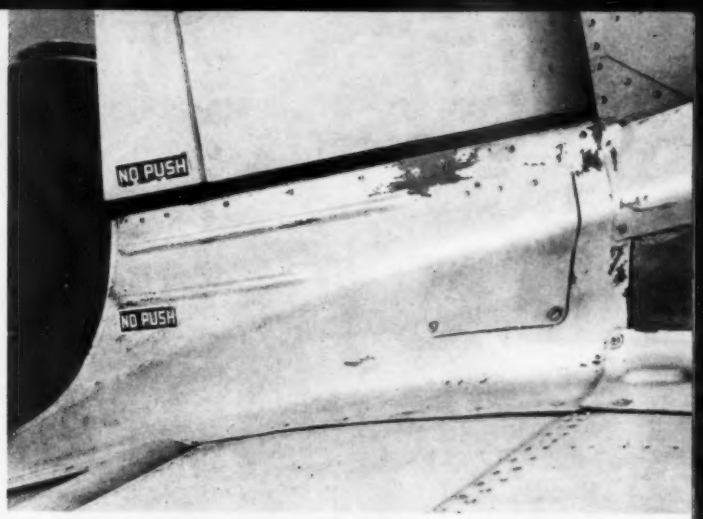
Examine cables, especially at pulleys, for fraying and binding. Pulley covers should be secure, but not rubbing against cable. There should be sufficient slack in cables to permit free movement of the controls.



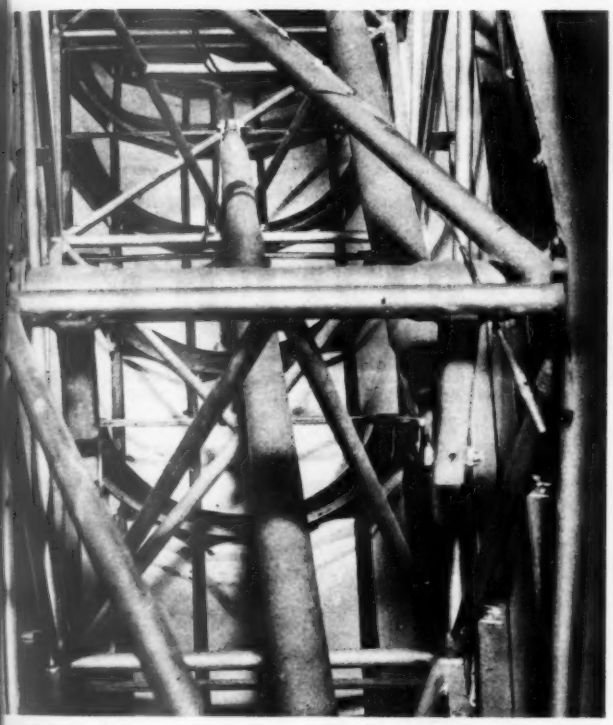
Look for kinks, bows and dents in struts and spars. See if joints have loose bolts, elongated bolt holes. Test inspection plates for security. Check the aileron control cables for proper slack and free movement.



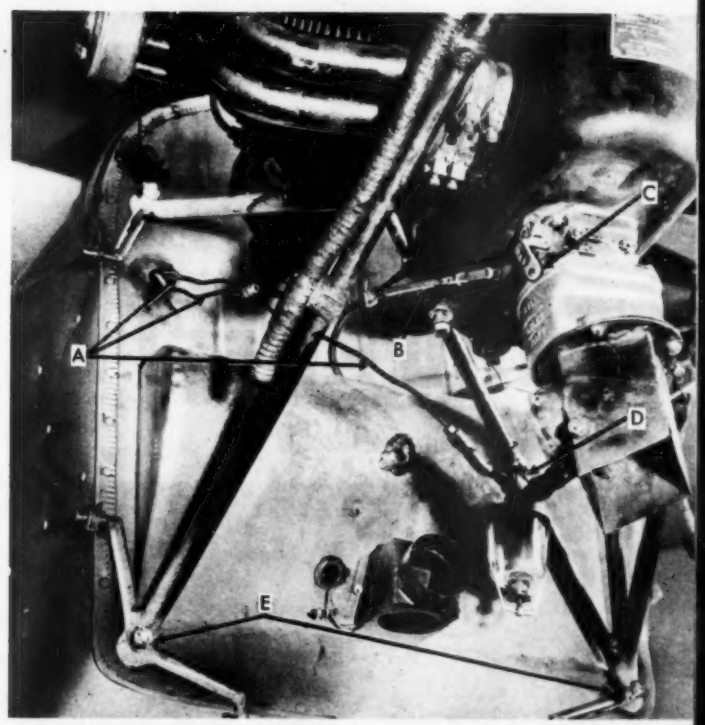
This Valiant's hatch panels are so discolored and pitted that features of pilot are blurred. Pyralin or plexiglas in this condition is beyond reconditioning. Buyer of this plane would have to replace all panels.



Deep cuts in the thin, outer coat of pure aluminum on a used metal plane cause flaking and corrosion of the alloy underneath. If metal corrodes through entire skin covering, structural failure might result.



Fuselage frame tubing of this Fairchild PT-19 is smooth, symmetrical; bulkheads secure. Bulges or dents would indicate possible strain. Look for dirt, traces of oil-stains or other fabric-weakening agents.



Check engine for: (A) oil pressure and gas gauge line cracks; (B) throttle and (C) throttle arm freedom from binding or dye stains indicating leak; (D) fuel line security; (E) tight engine-mount bolts.

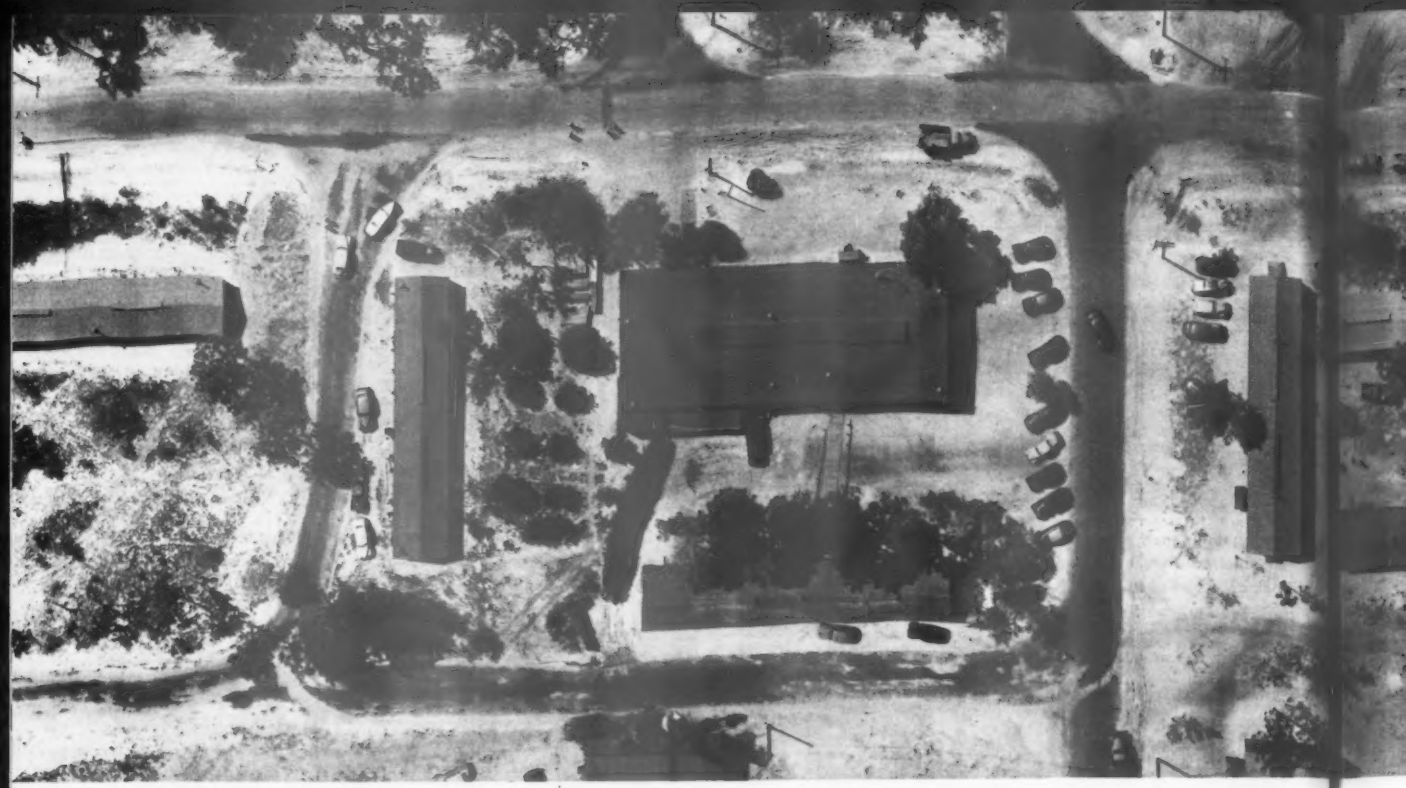
purchasers of used aircraft are buying practically sight unseen, possibly because they feel that any inspection they could accomplish would be of little value. To them, an aircraft is a mysterious thing of longerons, struts, dihedral and incidence.

There is nothing mysterious about anything mechanical, however. An airplane is merely a mechanical vehicle that flies. As such, it can be inspected for proper maintenance and general condition by reference to certain pertinent papers accompanying it and a good visual check.

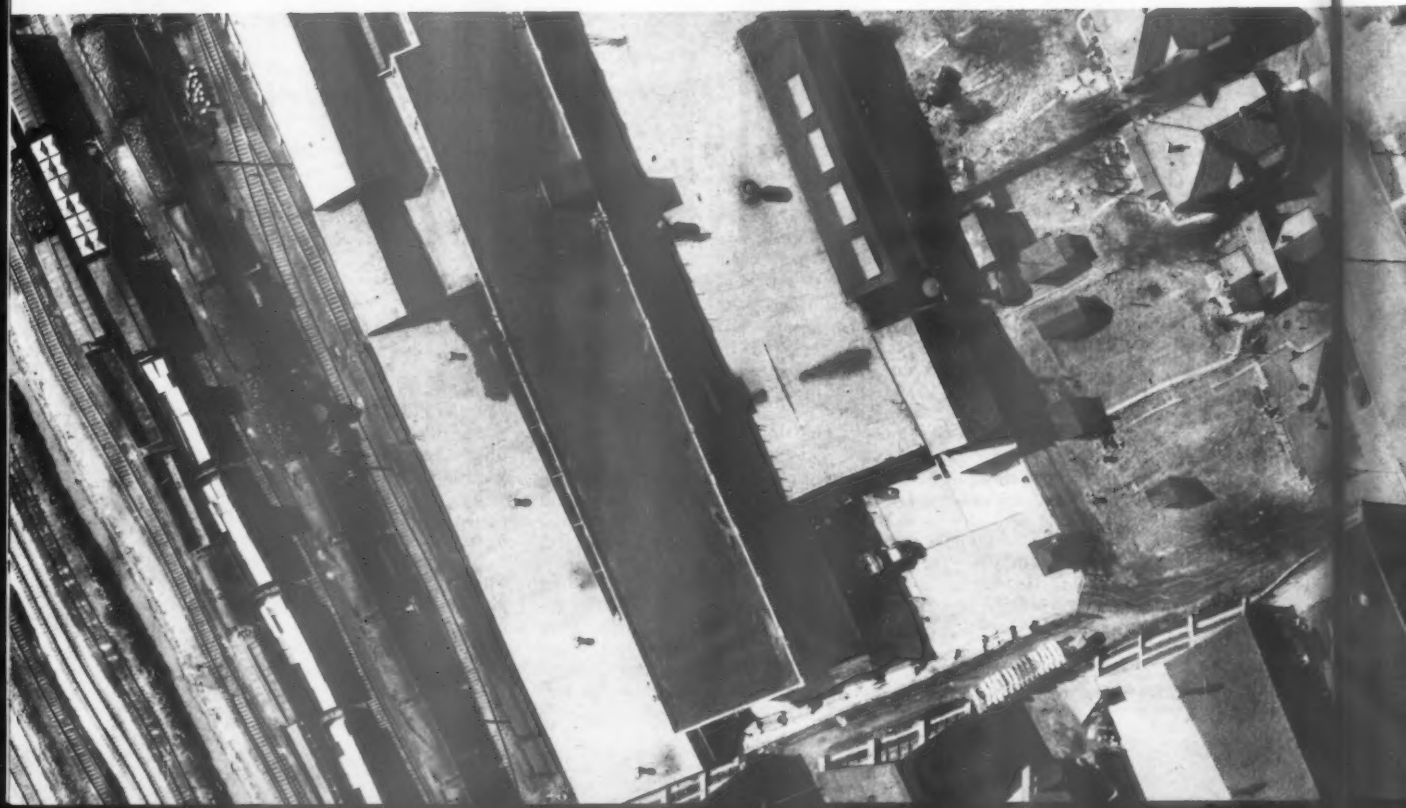
Most pertinent papers to be checked are: Form 500 (Registration); Form 308 (Airworthiness); Form 309 (Operations Record); Form 319 (Periodic Inspection Report), and the aircraft and aircraft engine log books. Check the registration certificate to see if the aircraft is properly registered in present owner's name. If it is properly registered, the name should appear on the *face* of the certificate, under space marked "owner."

Should you buy the aircraft, see that the registration certificate is properly signed over to you on the reverse side. The proper procedure then is to procure a proper bill of sale (original and copy), immediately make an application for registration, and mail the application with your original bill of sale and proof of citizenship directly to the Certificate Section, Civil Aeronautics Administration, Washington, D. C. Retain the signed copy of your bill of sale for future use in case your original is lost. If you fail to apply upon the date shown on your bill of sale, the registration certificate is automatically suspended and further flight of the aircraft is unlawful until such time as a new registration is received by the new owner. If proper application is made, and the proper transfer of the certificate has

(*Continued on page* 138)



AERIAL STRIP CAMERA



THE two photographs on this and the opposite page are the work of a remarkable new aerial camera, the S-7 shutterless, continuous-strip aerial camera developed by the AAF. The S-7 can take a continuous picture 200 feet long and 9½ inches wide; 11 miles of terrain have been photographed on one strip. The S-7 was developed at Wright Field because of the demand for a camera that would take the sharpest possible pictures at high speed and low altitudes. The conventional shutter proved useless. Instead, a narrow slit, the width of the film, was installed. Then a mechanism that synchronizes the speed of the film to the speed of the plane was perfected. Result was the S-7 and some of the sharpest aerial photographs on record. Once a plane flying 400 m.p.h. at 300 feet photographed a clothesline. With a magnifying glass, you could count the buttons on a shirt blowing in the wind.

Caught on an Italian road, this German supply truck was riddled by the eight .50-cal. guns of a Thunderbolt. Fighter-bombers make highway travel by day extremely hazardous.

One P-47 planted its two 1,000-pounders neatly on this track. Bomb at left also cut telegraph lines.

The Thunderbomber

Four P-47D's cross the Apennines toward the German lines. Each is carrying bombs and a belly tank.

FIGHTER-BOMBERS are the deadliest all-around combat aircraft in the world today. The photographs on these pages show some of the handiwork of one of the world's best fighter-bombers, the Republic *Thunderbolt*. These single-seat giants are armed to the ailerons. In addition to the standard fixed armament of eight .50-cal. machine guns, they each can carry six heavy rockets, two 1,000-pound bombs and enough fuel for a range of about 1,000 miles—all at the same time. Newest wrinkle is the substitution of a new type fire bomb for the standard demolition bombs. The fire bomb looks like an external fuel tank, but is filled with an incendiary explosive that has proved deadly against whole cities or foxholes.

The *Thunderbomber* was developed largely by the 12th Air Force in Italy. Its fame and use spread to every other air force using the P-47. Gross weight of these planes averages 15,000 pounds (wing loading: 44 lbs. sq. ft.). Service ceiling is 40,000 feet.

Rail yards at Lingerfild were a blazing shambles after this raid by 9th Air Force Thunderbombers. Building being hit in foreground housed rail workers. Following P-47's blew up gas truck beside house, then freight cars. Note fleeing Germans.

Fighter-bombers did this to the Kaiserlautern marshalling yards in Germany. Bomb crater can be seen in left foreground. Note shadow of Mosquito that took this picture (left center).

Most of these pictures were taken by trailing P-47's with this K-25 camera installation, mounted atop wing bomb rack.

We suffered too. But this Thunderbomber's pilot got it home despite flak-chewed wings, wrecked oil system. Unable to see from cockpit, pilot was "talked" down by control tower.

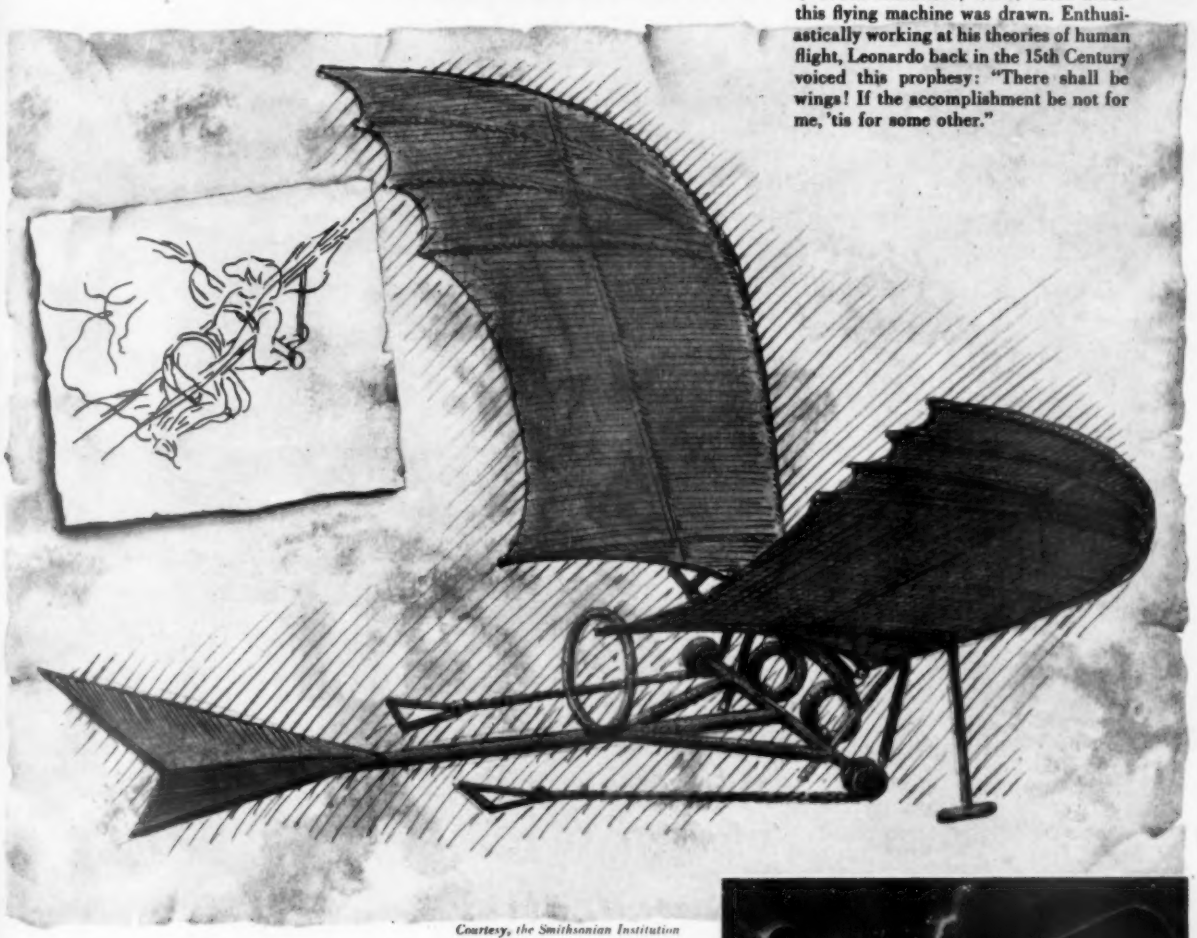
Direct flak hit nearly cut off this P-47's wing, but it brought its grateful, grinning pilot home unscratched.

Flak cut the oil line of this Thunderbomber while its pilot, Lieut. Edwin L. King of New Lebanon, O., was strafing enemy gun positions in Italy. Oil completely covered cockpit, pilot and parachute. With his feet in puddle of oil, Lieutenant King flew home, landed as the engine froze up.

THE WINGS OF LEONARDO da VINCI

. . . were low on LIFT

Years before he painted the Mona Lisa, Leonardo da Vinci sketched the designs ("Codex Atlanticus," 1490) from which this flying machine was drawn. Enthusiastically working at his theories of human flight, Leonardo back in the 15th Century voiced this prophesy: "There shall be wings! If the accomplishment be not for me, 'tis for some other."



Courtesy, the Smithsonian Institution

"*Lift*" is caused by air passing over a wing and is what makes an airplane fly. "Drag" is the resistance of air to the plane's passage and is what fights against the airplane leaving the ground.

In fact, you can trace the progress of human flight in the battles of Lift versus Drag. You can trace it in progressively lighter and more powerful propulsion... from the Wright brothers' 12-horsepower engine to today's great multi-bank motors, and on into gas turbines and jet propulsion.

You can trace it in the step-by-step reduction of Drag . . . from guy-wired biplane through cantilever internally-braced monoplane wing and the all-metal stressed-skin fuselage (both Northrop "firsts"). And you can trace increasing usefulness and control of Lift surfaces through developments like the Northrop retractable aileron, as used on Northrop's P-61 Black Widow.

What next? Northrop's peacetime goals include far-reaching advancements in propulsion . . . and aircraft designs like the Flying Wing, in which nearly every part contributes to Lift. Northrop Aircraft, Inc., Hawthorne, Calif.

The Black Widow now night-fighting on world battlefronts. Designed and mass-produced by Northrop

NORTHROP *Creators of the* ***Flying Wing*** *and the* ***Black Widow*** *P-61 Night Fighter*

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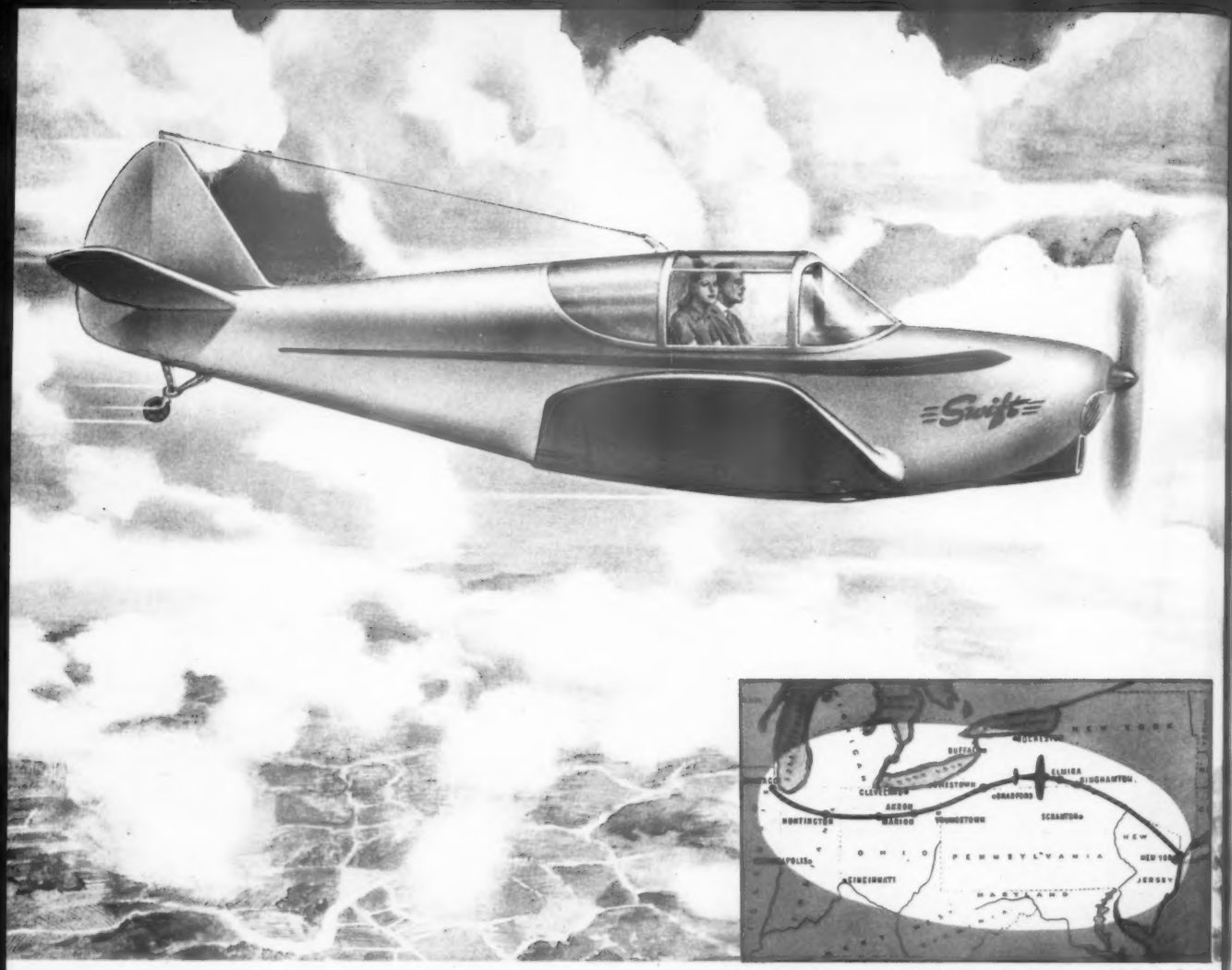

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We anticipate that your new *Swift* will soon be available through the dealer in your territory.

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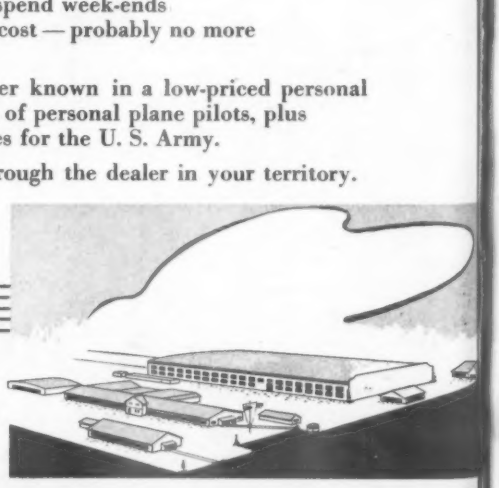


Long Range Flight Crews

By
CHARLES
MATTINGLY
Supervisor of Navigation
Consolidated Vultee Aircraft Corporation

A five-man crew is minimum for long flights, but Pan American and American Export use eleven.

A "minimum" long-range flight crew at its stations in a Pan American Clipper. They are pilot, co-pilot, radio officer, flight engineer and navigator.

WHAT constitutes a minimum flight crew for long overwater flights?

This is a question which comes up now in almost every gathering of aviation men. Manufacturers need to know how many men will be operating the airplanes they are producing so their planes can be built accordingly. Airline executives want to effect the most efficient and economical operations consistent with present standards of safety. The Government, through the Civil Aeronautics Administration, has to set up regulations covering airline operations, and the crewmen who are to fly the planes want to know what their responsibilities are going to be.

Other persons also are interested. Among them are insurance underwriters, our international air conference representatives, shippers, businessmen, and citizens who look forward to and plan for international air commerce.

All agree that the paramount issue is safety. Economy and efficiency, while vitally important in this highly competitive field, are without question secondary. Thus it might appear at first glance sufficient to carry as crew all the experts and specialists who could contribute to safe operations. Under our present standards, on both military and commercial multi-engined aircraft operating on long flights over water or uninhabited areas, the crew consists of a minimum of five men. These are captain, co-pilot, navigator, engineer and radio operator. There have been so many instances in which it has taken all the knowledge, effort and skill of the five to complete flights that further discussions might seem unnecessary.

I am talking here about minimum crews only. Two airlines [Pan American and American Export] use 11-man crews on their long-range flight operations. Crews on one line [Pan American] are made up of a captain, a first officer as co-pilot, a second officer as navigator, third and fourth officers as pilots, first and second flight engineers, first and second radio officers, a senior flight steward and a steward or stewardess. The other airline 11-man crew consists of a captain, first, second, third, and fourth officers as pilots and navigators; a radio officer and assistant, an engineering officer and assistant, a purser and a stewardess.

But here the airline executive counters with the point: We are going to have better planes, better radio navigation aids, greater speed and hence less air time. Flying will be easier because planes will go higher to avoid inclement weather. There will be new flying apparatus to make the cockpit job easier. So there's yet the question: "Can a three- or four-man crew do the job?"

What personnel would comprise the three-man crew? Captain and co-pilot are absolutely necessary. So how will the duties of the navigator, flight engineer and radio operator be divided? Would the captain and co-pilot do the navigating and have a combination engineer-radio operator?

As an experienced navigator and instructor, I am often asked: "Do you think the navigator's duties can be taken over by the captain and co-pilot?"

Always I answer, "Yes."

We know this is done on the commercial airlines in the continental United States. But the pilots flying over the continent have emergency landing fields every 50 miles along the routes they

Both Pan American and American Export use 11-man crews on their long-range boats. Here is a Pan American captain working at his desk behind the navigator's station on a big Clipper.

Engineers are essential. During Pan American's first two years of operating Boeing 314's, 431 repairs were made during flight.

travel, and whenever necessary they can change their course and proceed to alternate airports.

Not so in the Pacific. Nor over the Atlantic, or skirting the North Pole on an over-the-top flight.

So although I say "yes" when asked if the men in the cockpit can take over the navigator's job, I inquire:

"Would you want to fly without a full-time navigator between the mainland and the Hawaiian Islands, knowing that one time out of 10 adverse weather and unexpected emergencies will arise?"

When bad weather is encountered or emergencies occur, it's a five-man job to get through safely, even with the best four-engined equipment. I know. I've been flying the route from California to Honolulu, and from Honolulu on to Manila or Sydney for the past five years.

There never has been a time when I wanted to push any of the other crew members overboard, and I tried to function expertly enough so that they would not have traded me for my weight in gasoline or payload.

But in spite of all this there is still the secondary point of economy to be considered, for airlines have to make money. The flight crews are high salaried men. Their pay is an important figure in operating expenses. Airline executives, therefore, are looking for the opportunity to eliminate one or two of them. Also there is the question of weight. If two crewmen can be left behind, then two pay passengers or some 350 to 400 pounds of mail or express can be carried. Both operating costs and revenues are affected. From the financial side, there are double advantages, then, to reducing the flight personnel.

Years of experience have taught us that the navigator and radioman are the busiest members of the crew on any long-range flight. While their duties are largely classified as "routine," theirs is a continuous exhausting jog. Pilot and co-pilot are concerned with flying the aircraft on heading, and watching engine and gasoline performance. Their job, however, is largely one of watching instrument dials and making an occasional adjustment on the automatic pilot involving no particular expenditure of energy.

Conversely, any honest crewman who has flown long-range will admit readily that the men who really have to work hard for their money are the navigators and radiomen. As for the engineers, they are occupied but never really busy unless an emergency occurs which demands their expert attention.

In summary, each of the five men in the crew is a specialist. When he does something it must be the right thing. And when duties of crewmen are doubled, difficulties—even hazards—quickly arise.

Shortly after Pearl Harbor we were delivering some *Mitchells* across the Pacific from California to Australia. In order to load sufficient fuel for the long hop of 2,400 miles from the mainland to Honolulu, we were instructed to carry four-man crews. Due to the fact that the nose compartment was loaded with auxiliary tanks it was impossible to operate the automatic controls. Therefore the planes in this flight had to be flown all the way by hand.

The company flight directors called those of us who were to make the flight into conference. A number of decisions were left to us. We arrived at a plan we all thought was pretty sound. Each plane was to have a pilot and co-pilot. We were unanimous on that. Also each was to have a full-time radio operator, one qualified to handle the Army radio equipment and maintain a continuous watch. Thus, half the planes could have navigators, half could have engineers.

We organized in flights of four, with the first two planes in each group carrying navigators and the last two having engineers. We examined the plan from every angle. Even though all of us were experienced in long over-water flights and knew how frequently emergencies occur,

(*Continued on page* **138**)

Letters

THE "BUTTON-NOSE" BOYS

Sirs:

On page 63 of FLYING's June issue you have a picture of a B-17G named *Button Nose*. Also shown are members of the crew with whom I flew several combat missions. In fact, the central figure was *Button Nose's* command pilot the day I was shot down and had to bail out over France on my last mission. *Button Nose* was our plane that day. Incidentally, this plane was christened by the movie actor, Edward G. Robinson, during his tour of American bases in England . . .

LIEUT. JAMES J. LONG

Victorville, Calif.

WANTS LOW-COST PLANE

Sirs:

I notice lots of planes discussed in FLYING that will sell post-war for about $4,000, but where are all these low-cost planes, priced to sell at $1,000 to $1,500?

Have the manufacturers forgotten there are thousands of pilots who want to own a lightplane but will be unable to do so if the price is in the upper brackets? I'd like a low-wing job, with a 65-h.p. engine, two-place with a 110-m.p.h. cruise and a 40-50-m.p.h. landing speed. Possibly I'm asking too much—but I'd think that wartime mass production methods would enable the cost of post-war planes to be brought down within the reach of us putt-putt pilots.

LIEUT. R. M. PAGE

APO, New York, N. Y.

● Present indications point to immediate post-war lightplane prices slightly in excess of those prevailing in pre-war days. Many factors which act to reduce prices will be inoperative until the aircraft market is stabilized. FLYING is all for the low-cost lightplane.—ED.

RE "ATLANTIC WEATHER REPORT"

Sirs:

"Atlantic Weather Report" in FLYING's March issue was of great interest to me—I was one of the navigators who flew with the three weather planes during the winter of 1943-44. We all were doubtful then if the winter weather study could be representative of future winter periods. ATC experiences later proved, however, that no longer will flights across the Atlantic be interrupted except for local weather conditions.

The radio altimeter described . . . is one of the most important instrument developments of the war. Its navigational value cannot be too highly stressed, for this aid provides the proper pressure relationship essential to accurate navigating. The "secret radio device" mentioned by the author, supposedly to pin-point a plane's position, is over-rated since static conditions can interrupt this service. None of these newer aids can, as yet, replace the slower but reliable methods of celestial navigation.

LAWRENCE G. REGAN

New York, N. Y.

A WORD TO MR. PACINI

Sirs:

Far be it from me to criticize another man's flying, but Pacini's "I Learned About Flying From That" in the June issue of FLYING, indicates he made another error—a big one. If he had only 600 feet in which to take off and clear a large silo, he should have made his friend find other means of transportation and taken off solo.

Incidentally, you certainly painted a true picture of too many airports in that feature "How *Not* To Run An Airport."

HAROLD B. PRATHER

Georgetown, Ky.

BATTLE OF THE AERODYNAMICISTS

Sirs:

"Flight Problems" in the Letters column of the June issue presented a very interesting question. But a plane flying from one stratum of moving air to another stratum *can* stall.

LIEUT. COMDR. JOHN R. HOYT, USNR

Washington, D. C.

Sirs:

Regarding your answers to Carl Mendius in the Letters column of the June issue of FLYING, you rate a big zero on the first question . . . The plane *will* stall under the conditions given. It is my contention that any airplane is going to stall if its air speed is reduced from 60 m.p.h. to 20 m.p.h. It will make no difference whatsoever whether it slows down through throttle reductions or from a decrease in wind velocity.

BOB BARRETT

Bremerton, Wash.

Sirs:

Your reply to Mr. Mendius would apply correctly to a gradual transition in air velocity but would not apply to a sharp-edged gust. It is my opinion Mendius is correct.

LIEUT. D. L. DUBOIS, USNR

St. Mary's College, Calif.

Sirs:

. . . Carl Mendius . . . is dead right. . . . The plane would stall.

H. H. BROWN

Lititz, Pa.

Sirs:

. . . You have disregarded the forces of inertia. It is my opinion the plane would stall . . .

M. P. WOODWARD, JR.

Culver, Ind.

Sirs:

. . . As a somewhat distant analogy, would a plane flying at 150 m.p.h. IAS against a hurricane of 150 m.p.h. have G's exerted on it if the pilot suddenly pulls back on the stick? If you say yes, I give up.

D. H. SMITH, AMMF 3/c

FPO, San Francisco, Calif.

● FLYING endeavored to provide a practical reply to a purely hypothetical question. We were not given a stalling speed but assumed it to be 30-35 m.p.h., since the level cruising speed was given as 60 m.p.h. indicated air speed. At this speed the plane is in equilibrium.

Hitting the gust would cause the plane (1) no longer to be in equilibrium, (2) to gain altitude and (3) immediately

(*Continued on page* 142)

FLYING

". . . Off we go into the wild, blue yondah . . ."

THE LIBRARY

AMERICAN AIR NAVIGATOR, by Charles Mattingly; published by Ziff-Davis Publishing Co., 185 N. Wabash Ave., Chicago 1, Ill., in 1944. 229 pages. Price $6.

For the novice navigator and those who desire a working knowledge of terminology used in the science of navigation, this book comprises a complete and comprehensive guide.

The author, chief navigator for Consolidated Vultee Aircraft Corporation, gives the reader a concise but complete explanation of each step in all navigational phases. The book is replete with maps, charts and illustrations to supplement the written text. Chapters have been devoted to explanation of the instruments used in obtaining geographical fixes by all known means—one dealing with the functions, construction and purposes of the octant, chief aid of overwater navigators.

In detailing intricacies of dead reckoning, radio navigation and celestial navigation, the author has devoted several pages in each section to presentation of work problems to be solved by the reader. Answers are given in the back of the book where there is also an up-to-date glossary and the index.

The treatment of celestial navigation covers two-thirds of the entire book, with each step carefully explained and illustrated. Those who are not conversant with the procedures employed by our global navigators should be able to grasp fundamentals. Star charts and conversion tables give the reader an opportunity to solve the problems outlined with comparative simplicity. If read carefully, the book should be of considerable value in learning navigation.

LAWRENCE KEIL

MISSION BEYOND DARKNESS, by Lieut. Comdr. Joseph Bryan, III, USNR, and Philip Reed; published by Duell, Sloan & Pearce, Inc., 270 Madison Avenue, New York 16, New York, in 1945. 133 pages. Price $2.

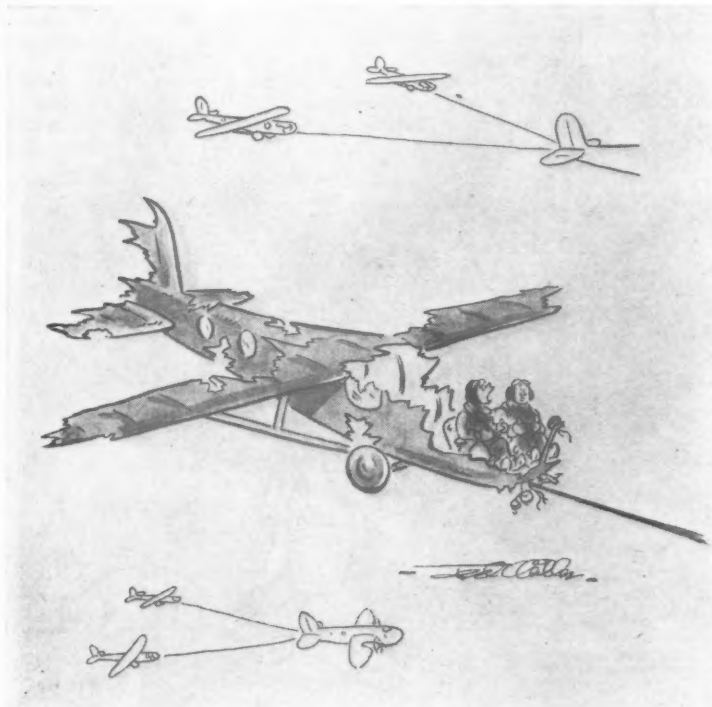
Here is the unforgettable story of one day and night in the lives of the 64 members of the carrier *Lexington's* Air Group Sixteen. The *Lexington* was part of Task Force 58 which struck at the Japanese fleet on June 19, 1944, in the First Battle of the Philippines. Our planes sank one Japanese carrier and four tankers, probably sank another carrier, another tanker and a destroyer, and damaged several other ships. Our losses were 96 planes and 49 men. Air Group Sixteen lost nine of the 34 planes it sent out and four of the 64 men. For stark reality, few books can equal *Mission Beyond Darkness.* What the men of Group Sixteen thought, felt and endured in a few compact hours is told in a vivid and forceful fashion.

You come to understand what is involved in fighting off the Japs or in flying through a solid barrage of their anti-aircraft. You share their feelings when they see friends ditch in Jap-filled waters. You search with them for their carrier in the dark with instruments shot up and only a few gallons of gas left in the tanks.

The entire account, according to the authors, ". . . is derived wholly from narratives by the survivors, from statements by officers and men of the *Lexington*, and from the author's witness. No incident has been fabricated. No word or thought or action has been ascribed to anyone without his own authority." It is this factual treatment that makes the book valuable as well as interesting.

Sixteen pages of excellent U. S. Navy photographs illustrate the book. Many of the men of Air Group Sixteen are pictured on these pages.

LYNN H. SLIFE



FLYING

"It should be interesting when he cuts us loose!"

SHORT VIEWS

THE SUPERFORTRESS IS BORN, by Thomas Collison; published by Duell, Sloan & Pierce Inc., 270 Madison Avenue, New York 16, N. Y., in 1945. 218 pages. Price $3.

Here is a step-by-step story of the evolutionary progress of the *Superfortress.* Portrayed in simple terms, the trials, tribulations and successes met in the design and test stages of the big bomber are well covered. The reader can readily grasp the magnitude of this aviation project, so vital that it required the organization and training of a new Air Force—the 20th.

Design drawings and two sections of photographs aid in portraying the story of the B-29.

DYNAMIC METEOROLOGY, by Jorgen Holmboe, George E. Forsythe and William Gustin; published by John Wiley & Sons, Inc., 440 4th Avenue, New York 16, N. Y., in 1944. 378 pages. Price $4.50.

This is a textbook useful only to those intent upon a professional meteorology career. A reader devoid of a general understanding of physics and calculus will not be able to plumb the depths of the thermodynamical and hydrodynamical principles expounded. However, for those persons adept in the methods of vector algebra and calculus, the text and illustrations will be of a great deal of interest.

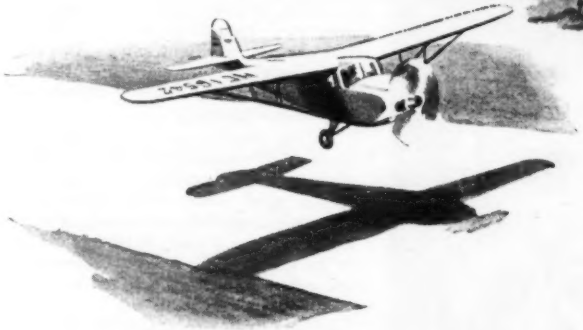
COASTS WAVES AND WEATHER, by John Q. Stewart, published by Ginn & Co., Statler Bldg., Boston, Mass., in 1945. 348 pages. Price $3.75.

The outstanding feature of this book is its photographs. Since it deals mainly with coast lines, terrain and routes; oceanography, and meteorology, it would lend its greatest meaning to those with an interest in marine and air navigation. Contained in the index is a complete list of books on the varied phases of hydrography, and includes global sailing directions published by the U. S. Navy. END

GO UP, young man!

They used to say, "Go West, young man!"—but America's new frontier is in the air. Aeronca's making it possible for thousands of people to have personal planes postwar. New planes within the means of the average man—designed so that anyone who can drive a car can fly. How're we doing it? We . . .

Apply wartime knowledge to peacetime plans. You see, we're 100% on war work now. It's brought us the Army and Navy "E" (we're the only light aircraft company to receive this award). The war has speeded up our more than 16 years of previous experience—and we're now testing personal planes far ahead of any you've seen before. And we also have . . .



Booklets that answer many of the questions about operating the airports where these planes will be stored and sold and serviced. This way, postwar personal transportation can be revolutionized, as it was with the coming of the automobile. These interesting, informative booklets tell the whole story. Why not clip the coupon and send for them?

AMERICA'S PERSONAL PLANE

AERONCA

has an important message for air-minded people

Export Agency—Aviquipo, Inc., 25 Beaver St., New York 4, N. Y.

Department F-8
Aeronca Aircraft Corporation, Middletown, Ohio
Send me your valuable booklets. Enclosed is 10¢ for each booklet.

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_____"Why You Should Be An Aeronca Dealer"
_____"Aeronca, The Plane You'll Want To Fly"

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AOPA NEWS

The Aircraft Owners and Pilots Association (AOPA), with National Headquarters Office located in the Carpenters Bldg., Washington 1, D. C., is a non-profit organization composed exclusively of pilots. It looks after the pilot's best interests in all phases of aviation and helps individual pilots with their individual problems. The AOPA operates with a full-time professional staff and is the largest group of civilian pilots in the world. This column is edited by the Aircraft Owners and Pilots Association and opinions contained in it are not necessarily those of FLYING. A special bulletin is sent each month to all registered AOPA pilots and also confidential newsletters from AOPA's Washington staff are sent members from time to time.

MANUFACTURERS SEEK RULE CHANGE

Many manufacturers of personal aircraft have requested that AOPA support their campaign to bring about a simplified set of CAA regulations pertaining to non-air-carrier aircraft design. This stand is based on the belief that the pilots of aircraft in general must shoulder more responsibility in operating their aircraft within all established limitations and that Government regulations henceforth should be based on two fundamental considerations:

1. That it is the clear responsibility of a manufacturer and the CAA to establish safety minimums for those phases of the airplane's performance which *all* aircraft must meet or exceed.

2. That it is also the responsibility of a manufacturer and the CAA to make available to the operator, in easily understood and non-technical language, certain operating information to enable him to recognize clearly the airplane's characteristics and govern his operations accordingly. Such *certificated* information will also enable the pilot to determine for himself the suitability of an airplane for his intended use.

It is proposed that this information be entered on a standard form to be supplied with the other certification data by the CAA. This certificated characteristic sheet of operating information allows elimination of certain minimum performance requirements which, manufacturers believe, will be a long step forward in the interests of safety in flight since it will permit greater latitude of design in all types of aircraft.

Manufacturers contend that present CAA regulations hamper progress and that the new manufacturer's code is based on the philosophy that (1) too detailed regulation is extremely undesirable since it places Government in the position of dictating airplane design rather than of leaving it in the hands of the designer and manufacturer; and (2) safety of personal aircraft operation is related directly to the extent of the pilot's knowledge of what his particular airplane is capable of doing. The opinions of AOPA pilots on this interesting proposal are desired by AOPA National Headquarters so send them in.

NEW RULES DEMAND SAFETY

The new Civil Air Regulations, effective July 1, place increasing responsibility on aircraft owners and pilots. AOPA joins John H. Geisse, personal plane assistant to the Administrator of Civil Aeronautics, in sounding a warning to civil pilots that their behavior under the liberalized regulations will determine the future of non-scheduled flying in the present generation.

To quote Geisse: "Do not for one moment believe that there was any unanimity of opinion as to your ability to take on the responsibility given to you under the revised regulations. There are many who believe that we will have an immediate increase in accidents when the new regulations go into effect. Their opinion cannot be cast aside as they, for the most part, are men possessed of experience that merits respect.

"They may be right. If time and you prove that they are, then *regulation will come back with a vengeance.* Private flying will have lost its chance to become a major factor in aviation. It cannot reach any such stature loaded down with regulation."

AOPA members who own aircraft are cautioned that, except in cases where their airplane is actually stolen, they are responsible for the pilots whom they permit to fly their aircraft, whether by loan or rental. In similar manner, instructors are to be held largely responsible if their students crack up the airplane while flying solo.

It is believed that, in order to protect this new freedom for the many pilots who measure up to its responsibilities, the CAA will feel that severe penalties should be meted out to those who violate these basic safety regulations in order to discourage others from following such an example.

Private Pilot Preston Doerfler, AOPA No. 9530, who organized and is president of the new and successful AOPA Colorado Unit.

INSURANCE FOR AOPA PILOTS

For many months AOPA's staff has been compiling facts and figures relating to personal aviation and aircraft accident insurance. Several preliminary reports covering various insurance fields have been previously published in the AOPA *Pilot.*

Knowing what the present insurance field has to offer pilots, the next question to determine is the *kind* and *amount* of insurance AOPA members desire to have.

Of all AOPA members (in a group of 5,000) who answered a recent questionnaire, 74 per cent indicated that they were aircraft owners. This fact has led AOPA officials to believe that aircraft liability and property damage coverages and other aircraft policies—hull insurance, fire and windstorm, collision, etc.—may be as popular as the personal accident type of insurance.

Most AOPA pilots, it is felt, have a limited knowledge of aviation insurance matters; many feel that many current premium scales are too excessive. There appear to be two methods of reducing rates: (1) Improved loss ratios which can be brought about by launching a vigorous safety campaign; (2) increasing the total number of persons who insure against aviation risks.

Of the two, most pilots will choose the first method, pointing out it not only would lower the aircraft loss ratio, but reduce pilot-passenger injuries.

AOPA is planning a continuing safety program, including a more thorough treatment of accident causes, tips on better piloting technique, and pressure to bring about more built-in safety features in personal aircraft.

Before further action on the second method of reducing insurance rates (by getting more people to insure), AOPA would need more information from its members regarding their insurance needs and desires. Would AOPA pilots desire to participate in a group insurance plan and enjoy somewhat lower rates than are obtained in the open market, or would members prefer to obtain their insurance from personal sources and have AOPA work confined to general attempts at reducing rates through an educational program of accident prevention?

This question involves a matter of policy on which all members are entitled to express an opinion, and further action on AOPA's plans for insurance relief will await a tabulation of AOPA pilot responses to this appeal for membership opinion. END

• During the war years, Breeze has produced in vast quantities essential equipment for our armed forces of land, sea and air which have helped bring Victory in Europe. Among the products which have borne the Breeze Mark of quality through wartime service are Breeze Radio Ignition Shielding Assemblies, Multi-lectric Connectors, Aircraft Armor Plate, Tab Control Systems, and Cartridge Engine Starters.

The diversified facilities and skilled hands which helped turn out this vitally important equipment will be available when final Peace comes to pitch in on the big job of reconversion. Until that time, the men and women of Breeze rededicate themselves to the task in hand — to keep production rolling on to ultimate Victory.

BREEZE
Corporations Inc.
NEWARK BREEZE MARK NEW-JERSEY

Other Breeze Products • FLEXIBLE METAL TUBING • SHIELDING CONDUIT • FITTINGS • FLEXIBLE SHAFTING

Return of the Private Plane

(*Continued from page 34*)

labor area or he would not be able to show hardship for his employees. Such a plant in a critical labor area would find its surplus employees referred to another plant in the area by the U. S. Employment Service.

All this sounds formidably complicated, but a number of plane manufacturers are going ahead to build civilian aircraft immediately. They will soon be coming off the assembly lines in ever-increasing numbers, as the following summary indicates:

AERONCA AIRCRAFT CORPORATION, Middletown, O. Manpower and materials have been so uncertain that Aeronca cannot predict exactly when it will be in commercial production. Aeronca continues as a manufacturer of components for warplanes but believes that production of civilian planes will commence "within 60 days after material and manpower are available." The 65-h.p. two-place tandem *Champion* and the side-by-side 65-h.p. *Chief*, both cruising at 90 m.p.h., will be the first planes built. Also planned are the 75-h.p. two-place, two-control, spin-proof, low-wing *Chum*, with tricycle gear. It is expected to cruise at 108 m.p.h. The two-place 90-h.p. *Arrow*, with retractable gear and expected cruising speed of 125 m.p.h., and the four-place *Eagle*, a family and business plane for which no specifications have been announced, also are planned.

AVIATION BOOSTERS, INC., Kansas City, Mo. This company has recently been organized by two engineers who have built the one-place *Skyhopper*, illustrated on page 32. Powered with a 50-h.p. Continental engine, the *Skyhopper* is expected to sell for about $1,000. Two-place and a four-place planes also are being developed.

BEECH AIRCRAFT CORPORATION, Wichita, Kans. At the time of this inquiry, Beech had not formulated specific plans. Production will be continued on the single-engined Beechcraft Model D17, and the twin-engined Beechcraft Model 18, both of which have a good backlog of orders for post-war delivery. Since the Army version of the latter now is in production, commercial deliveries could be made immediately upon receipt of necessary authorization. Deliveries of the Model 17 could be commenced within 90 days after receipt of the necessary authority and availability of the necessary space and facilities. Beech also plans to produce a single-engined airplane in the lower-priced field, about which the company is enthusiastic. Details have not been announced.

BELL AIRCRAFT CORPORATION, Buffalo, N. Y. This company appears to be mainly concerned with its helicopter, which has been quite successful. The company is quoted as stating: "for a long time to come helicopters will be used only by large business establishments, the armed services, and a relatively few private owners."

BELLANCA AIRCRAFT CORPORATION, New Castle, Del. The first of Bellanca's new *Cruisaires* is undergoing flight tests at New Castle. It is a low-wing, four-place monoplane with retractable landing gear and improved aerodynamic characteristics. The 125-h.p. Franklin engine is expected to give it a top speed of 165 m.p.h. at 2,350 r.p.m. and a 150-m.p.h. cruising speed. Price will be $4,500 compared with the pre-war price of $4,375. Four or five hand-made *Cruisaires* can be turned out by early fall for demonstration purposes. H. L. Thompson, secretary, says: "We are thinking in terms of hundreds rather than thousands of airplanes right now." The company is selecting about 50 good distributors from 400 to 500 applicants. Other Bellanca planes are in the design stage but none will be flying for about a year.

BOEING AIRCRAFT COMPANY, Seattle, Wash. Boeing admits only to "studying the personal plane field," but has not made any public announcement to date. Revocation of L-48 raises the prospect that the *Stratocruiser* will be operating on world air routes by the end of 1946. Other commercial types are under development.

CESSNA AIRCRAFT COMPANY, Wichita, Kans. The Cessna plant is still scheduled to capacity on military commitments. The company says: ". . . Along with these military commitments we now are able to make much faster progress in the development and testing of the new line of Cessna airplanes. Cessna will not begin by producing more pre-war models, but will retool completely for a new line of all-metal single-engine personal planes . . . The new line of Cessnas will start in the volume-price field with a two-place model, and will extend to include a high-performance, four-place model . . . The new models will not be designed for hand work production. They will be precision-built with dies, tools and jigs . . ." No specific forecast date for the beginning of sales on the new line of planes is possible.

COMMONWEALTH AIRCRAFT, INC., Kansas City, Kans. Commonwealth plans four lightplane designs after the war, "some of unusual design." No other information is yet available, however.

CONSOLIDATED VULTEE AIRCRAFT CORPORATION, San Diego, Calif. The Stinson Division expects to build five models, beginning with the *Voyager 125* a four-place craft, which was promised for production within 90 days after construction was given the green light. The *Voyager 125* will have a maximum speed of 128 m.p.h. and a maximum range of 580 miles. It cruises at 116 m.p.h. Other Stinson planes will include a two-place, low-cost plane; a three-placer; the *Skycoach*, a five-place high speed "plane of the future;" and a five to six-place twin-engined junior executive transport. The Stout Research Division of Consolidated has been experimenting with three planes —a roadable plane with engine in rear (the current model, see page 25, has the Spratt controllable wing), a roadable plane which would be primarily an airplane but could be taxied on highways for short distance; and a more conventional type of lightplane. The West Coast labor shortage confines Consolidated to military production in that area.

CULVER AIRCRAFT CORPORATION, Wichita, Kans. Culver does not have detailed information ready for release thus far. However, T. Bowring Woodbury, vice president and general manager, has indicated that the pre-war model will not be produced (he calls it a "dear departed friend"). Recent Culver ads and Woodbury's statements indicate that Culver is planning a non-spinnable, tricycle retractable landing gear airplane, with greater visibility, inherent stability, and "simplified" controls.

CURTISS-WRIGHT CORPORATION, Buffalo, N. Y. Curtiss-Wright has no current plans for producing aircraft, engines or propellers for the private aircraft market.

DOUGLAS AIRCRAFT CO., INC., Santa Monica, Calif. While it is almost certain that Douglas is working on preliminary designs for personal aircraft, the company admits to no immediate plans, although it has "engineers watching and checking other similar work." For the present, however, Douglas is so immersed in war work that it probably could not engage in civilian plane production.

ENGINEERING AND RESEARCH CORPORATION, Riverdale, Md. This company is now being converted for manufacture of the *Ercoupe* and, barring reverses due to military requirements, the first plane should be off the line about the middle of September or the first part of October. Erco is reluctant to give out facts about its new developments, but it is known that a twin-engined four-place plane is in experimental development. On the two-place *Ercoupe*, the 65-h.p. engine is being upped to 75-h.p. and eventually an even larger engine may be used. Experiments are also being made to retract the *Ercoupe's* tricycle gear.

FAIRCHILD AIRCRAFT DIVISION, Fairchild Engine and Airplane Company, Hagerstown, Md. Fairchild is in an area where manpower is still scarce and all materials on hand are being earmarked for production of the Fairchild *Packet*. Officials cannot predict when resumption of civilian aircraft will begin, but the company has announced a design for a family airplane, the low-wing M-84, which has been developed directly from the company's experienced in designing and producing the *Cornell* trainer, over 5,000 of which were built. The M-84 is expected to carry four or five persons and cost $8,000 to $10,500. The prototype now is being worked on. It will be "easy to fly and have a low landing speed so that beginners and lightplane pilots will be able to handle it safely." Fairchild also will resume manufacture of its high-wing four-place Fairchild "24" which has been produced during the war as the *Forwarder*.

FUNK AIRCRAFT COMPANY, Coffeyville, Kans. Funk is still engaged entirely in war work but does have materials on hand and has practically completed tooling for personal planes. Because of this, Funk believes it can be in production 90 days after cancellation of its present contracts. Funk is accepting inquiries on

BEFORE AND AFTER a B-29 "visit" to the Nakajima Aircraft plant at Ota, Japan. 755,900 square feet of roof lies gutted and blasted. Official Photo U.S.A.A.F.

LOST-- 1 Aircraft Plant 105,226,101 Faces

Losing face — and losing war plants — is a regular Japanese custom these days. It is a habit they don't particularly relish, but they don't seem to be able to do anything about it.

For there isn't much argument you can put up against a fleet of, say, 500 B-29's. They go where they wish, when they wish, hit what they're aiming at. And they come back again and again.

As the size and power of these Superfortress fleets increase, so does the responsibility of all Chandler-Evans workers. For an integral part of the great Wright engines that power these bombers are CECO carburetors. They are part of the great team of parts that go into the making of a Boeing B-29. They must function perfectly and efficiently regardless of altitude or temperature. Above all, they must be dependable.

We pledge that no single thing will be overlooked to maintain, and better, the high standards that have earned CECO carburetors this responsibility.

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CHANDLER-EVANS CORPORATION SOUTH MERIDEN CONNECTICUT, U.S.A.

distributorships and dealerships preparatory to completing a nation-wide sales and service organization. The new Funk 75 is a two-place side-by side high-wing monoplane with a 75-h.p. geared Lycoming engine and a cruising speed of 103 m.p.h., landing speed of 37 m.p.h., maximum cruising range 350 miles. It has an empty weight of 800 pounds, gross weight of 1,350 pounds.

THE GLENN L. MARTIN CO., Baltimore, Md. Martin has an engineering group which has been making inquiries in the small plane field. It is rumored that Martin has a two-place prototype but nothing definite is known. No immediate production is in prospect, however, because of heavy Navy schedules, including a new $183,000,000 contract.

GLOBE AIRCRAFT CORPORATION, Fort Worth, Tex. Present production plans are not known, but Globe has designed the new two-place 85-h.p. *Swift*, with retractable landing gear and high speed performance.

GRUMMAN AIRCRAFT ENGINEERING CORP., Bethpage, L. I., N. Y. Grumman has been the first company to build civilian planes since the war started with the production of 25 *Widgeons*, 16 of which have been completed. Grumman can build the *Widgeon* for anyone with a WPB okay for his order. It is exactly the same as the pre-war model except for a slight design change in the hull step. Grumman also is experimenting with a small pusher single-engined amphibian which it claims to be strictly experimental thus far. It is rumored to be almost completely spot-welded and to carry three persons. A small, fairly fast plane is also said to be on the Grumman drawing boards.

HIGGINS AIRCRAFT, INC., New Orleans, La. No Higgins production plans have yet been made available, but the company has talked of building the Bossi-designed helicopter.

HUGHES AIRCRAFT COMPANY, Culver City, Calif. Hughes has no immediate plans for production, but engineering and specification data have been completed on two civilian planes. One will be known as the Hughes *Executive Transport*, a fast, twin-engined all-metal job. The second will be the Hughes 18-place *Feederliner*, with a gross weight of 18,500 pounds and a 6,000-pound pay load. It will cruise at 186 m.p.h., stall at 57.5 m.p.h. and be fully maneuverable at 80 m.p.h. for operation at 500-foot altitudes.

INTERSTATE AIRCRAFT AND ENGINEERING CORP., Los Angeles, Calif. Present information, from Don P. Smith, president, is that this company will not build small planes after the war, but will build household articles instead.

KAISER AIRCRAFT. Henry Kaiser is associated with young Stanley Hiller in developing the *Hillercopter* with its counter-rotating airfoils. He has also purchased rights on the Stearman-Hammond, famous safety plane of a decade ago, which has a tricycle landing gear, and pusher-type propeller between twin booms. The Stearman-Hammond is non-spinnable and two-control. The version on the market a few years ago sold for $7,000.

LOCKHEED AIRCRAFT CORPORATION, Burbank, Calif. Lockheed is fully engaged in war production and, because of current manpower shortages, cannot undertake building planes for civilians at the present time. However, Lockheed plans a series of small planes of two, four and perhaps six-passenger capacity, involving the same aerodynamic principles as the sensational *Little Dipper*, a non-spinnable simplified control single-place Army liaison plane which was damaged at Washington National Airport this spring. It has not been verified that two- and four-passenger models are virtually completed. Information so far available indicates that Lockheed aims at keeping prices low. The *Little Dipper* has been reported as having take-off horsepower of 40, and a cruising speed of 90 m.p.h. It might sell for as little as $900 if Lockheed decides to manufacture it in quantity.

LUSCOMBE AIRPLANE CORPORATION, Trenton, N. J. Although Luscombe continues with production of all-metal precision components for military planes, and currently has the largest backlog of unfilled orders in its history, a limited number of re-designed *Silvaires* are expected to be available for release to dealers and distributors about the middle of the summer. Additional civil production "may" be underway in the fall. Meanwhile Luscombe is continuing its war production. The new *Silvaire* will have a 75- or 85-h.p. engine and a prototype has been completed. The plane has been designed for mass production and has new and better control characteristics, more stability and a slower stalling speed.

MCDONNELL AIRCRAFT CORPORATION, St. Louis, Mo. J. S. McDonnell, president, reports that the company has "no immediate product for the civilian personal aircraft market."

NORTH AMERICAN AVIATION, INC., Inglewood, Calif. North American has no plans at present for building civilian planes. North American's war production has been so efficient, however, that it is thought the company stands ready to build personal planes if the market demands.

NORTHROP AIRCRAFT, INC., Hawthorne, Calif. Northrop is caught in the West Coast manpower shortage and cannot contemplate building personal planes at present. It can be speculated that, after the war, it will resume tests on the Northrop Flying Wing, with refinements developed out of the many tests made with heavier planes of this type during the war. Northrop also might build gliders.

PIPER AIRCRAFT CORPORATION, Lock Haven, Pa. At the time of the revocation of L-48, Piper had materials on order but was not certain that sufficient materials would be available to put into effect its intended schedule, which called for 100 trainers in the first month and 200 per month thereafter over and above military commitments. Although it had never been produced commercially, the J5C *Super Cruiser* was adapted to serve the Navy as an ambulance plane. Now this three-place, 100-h.p. plane will be put into production for civilians and manpower appears adequate to manufacture at least 100 planes per month after material is available. Work is being continued on various experimental models, including the diminutive *Skycycle* whose horsepower has been upped to 55. It is pictured on the front cover. Work continues on the four-place 165-h.p. *Skysedan*, with retractable gear and flaps and 125 m.p.h. cruising speed and the PT-1 low-wing trainer from which the *Skysedan* developed. An unusual new Piper design is the two-place nonspinnable *Skycoupe* with 113-h.p. Franklin engine. It has a pusher engine and tricycle gear.

REPUBLIC AVIATION CORPORATION, Farmingdale, L. I., N. Y. Republic is preparing to go into full-scale production of its *Seabee*, the single-engined four-place pusher amphibian which it plans to sell under $4,000. These planes will be provided for anyone who can get WPB approval, and models are expected to be delivered in 120 days after order. Republic is tooling up its Evansville, Ind., factory at the present time, according to FLYING's informant, and when Army requirements

(*Continued on page* 84)

the British Say...

THE Boeing F-9 is the photo-reconnaissance version of the *Flying Fortress* (B-17). . . . There are seven versions of the Douglas *Skymaster* (C-54):

C-54 —Commercial passenger DC-4 converted to military personnel transport. Two GR-2000 engines. Gross weight, 60,000 pounds.
C-54A—Modified C-54, for carrying cargo, troops and stretcher cases. Gross weight over 60,000 pounds.
C-54B—Internal equipment changes.
C-54C—Only one experimental version built.
C-54D—Slightly modified C-54B.
C-54E—Absolute maximum capacity version of C-54A.
C-54F—Modified C-54B.

The C-117 is the AAF designation for the Oklahoma City-built C-47 which has the commercial airliner fittings of the DC-3. The Douglas Oklahoma City plant has an initial order for 150 C-117's . . . L-10 is the AAF designation for a Ryan liaison monoplane . . .

—THE AEROPLANE SPOTTER

AAF equivalent of the Navy's Consolidated *Privateer* (PB4Y-2) is supposed to be designated B-24M . . . This information was given for the Bell *Kingcobra* (P-63B): it has a 1,500-h.p. Allison engine and a top speed of over 400 m.p.h. Armament is one 37-mm. cannon and four .50-cal. machine guns . . . The Wright Aeronautical Corporation has developed a 3,400-h.p. air-cooled radial engine . . .

The photo-reconnaissance version of the *Superfortress* (F-13) has this equipment: Fairchild K-19 night cameras in the forward ventral turret, three trimetrogon mapping cameras and two reconnaissance cameras, a K-18 and K-22 . . .

—THE AEROPLANE

PLAN ...NOW... for your AVIATION CAREER

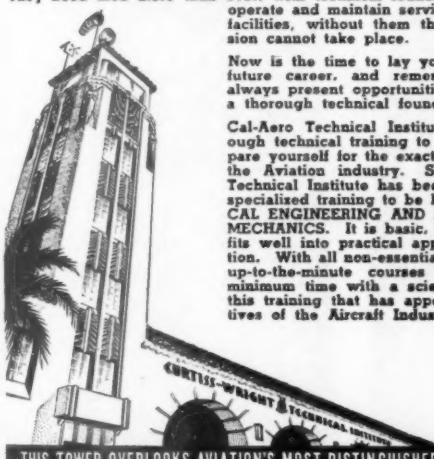
TRAIN IN SUNNY SOUTHERN CALIFORNIA

INSURE YOUR OWN SUCCESS WITH A SOUND FOUNDATION OF TECHNICAL TRAINING

AVIATION OFFERS YOU A GREAT FUTURE

BE PREPARED . . . . to take advantage of great opportunities to come in this field.

With wartime aviation to be put to peacetime use, countless opportunities await the technically trained man and his services will be valuable and in demand. Aircraft production will continue at a great rate in order to provide the thousands of private and commercial aircraft coming with the next few years. In addition to this, thousands of airports, airparks, flight stops and air harbors must be built. This means that thousands of hangars, machine shops, landing facilities and other needs must be provided to build up the utterly inadequate service and maintenance facilities for private and commercial planes. This also means the demand for thoroughly trained men will be great. Right now, instead of men with thorough technical training looking for positions, the positions are looking for them and aviation really needs these men who know their business. They need men more than ever, with technical foundation and ability to operate and maintain service and maintenance facilities, without them the necessary expansion cannot take place.



Now is the time to lay your foundation for a future career, and remember—Aviation will always present opportunities to the man with a thorough technical foundation.

Cal-Aero Technical Institute gives you thorough technical training to enable you to prepare yourself for the exacting requirements of the Aviation industry. Since 1929 Cal-Aero Technical Institute has been offering the best specialized training to be had in AERONAUTICAL ENGINEERING AND MASTER AVIATION MECHANICS. It is basic, broad in scope and fits well into practical application and operation. With all non-essentials eliminated, these up-to-the-minute courses are completed in minimum time with a scientific quality about this training that has appealed to the executives of the Aircraft Industry

"Cal-Aero" has an unsurpassed record of efficiency and experience with thousands of graduates in all phases of aviation plus the training of nearly 25,000 pilots and 7,500 mechanics for the Army Air Forces. It is recognized by the Aircraft Industry, California State Board of Education, on list of approved schools with U. S. Bureau of Immigration for non-quota foreign students, approved by Civil Air Board as Aircraft and Mechanics School, with C.A.A. approved courses—Member of National Council of Technical Schools—Member of National Aviation Trades Association—on list of approved schools on file with Veterans' Administration for Veterans Training under "G. I. Bill of Rights."

In addition, it is one of the oldest, largest and most substantial aeronautical schools in the nation and is located in the center of Southern California's giant aircraft industry, on its own huge airport.

Train at Cal-Aero in Sunny Southern California, where every training moment is spent learning something you will have to know, and subjects you study are the very thing you will have to do on the job WRITE OR MAIL COUPON TODAY FOR INFORMATION.

VETERANS

Cal-Aero Technical Institute is on the list of approved schools on file with the Veterans' Administration, making discharged service men attending Cal-Aero eligible for the educational benefits as provided under the "G. I. Bill of Rights." Many ex-servicemen are now enrolling and taking advantage of these benefits here at "Cal-Aero" in SUNNY SOUTHERN CALIFORNIA.

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UNDER PERSONAL SUPERVISION OF MAJOR C. C. MOSELEY, PRESIDENT AND FOUNDER, SINCE 1929

ON OUR OWN AIRPORT - IN THE HEART OF THE AIRCRAFT INDUSTRY

BE WISE—PROTECT YOUR FUTURE

MAIL TODAY • DON'T DELAY

WITHOUT COST OR OBLIGATION SEND ME FULL INFORMATION AND CATALOG ON THE COURSE CHECKED BELOW

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- ☐ SPECIALIZED ENGINE COURSE
- ☐ SPECIALIZED AIRPLANE COURSE
- ☐ POST GRADUATE AERONAUTICAL ENGINEERING COURSE
- ☐ SPECIALIZED AIRCRAFT SHEET METAL COURSE
- ☐ AERONAUTICAL DRAFTING COURSE, HOME STUDY
- ☐ AIRCRAFT BLUE PRINT READING COURSE, HOME STUDY

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Background of LEADERSHIP

Eclipse AVIATION ACCESSORIES

Eclipse-Pioneer Division • Teterboro, N. J. • Los Angeles 36, Calif.

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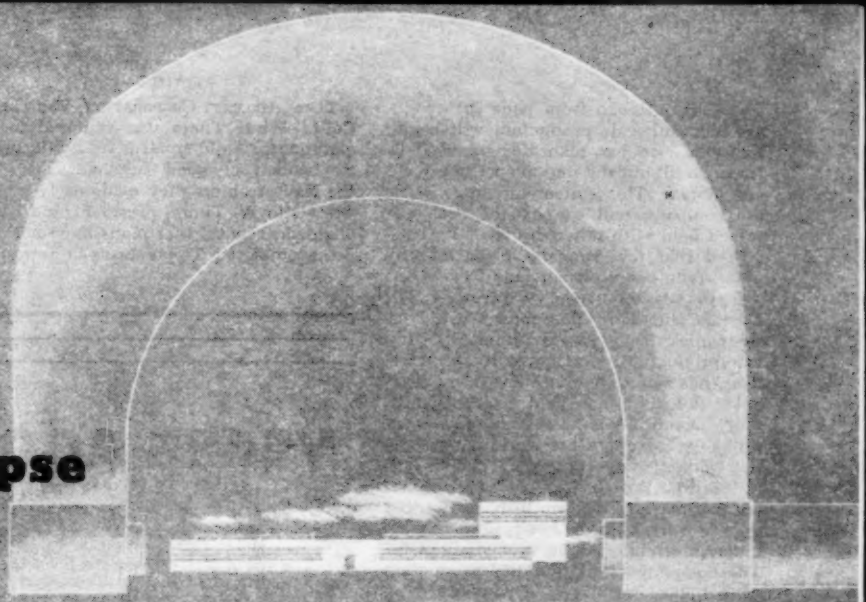


Eclipse precision manufacturing

....assures blueprint accuracy in every part and product

Whether running at top speed to meet today's peak production pace or to simply satisfy the industry's normal peacetime demands for the ultimate in airborne accessories: Eclipse Men of Production demand that *PRECISION PREVAIL.*

That Eclipse Aviation Accessories have proven so outstandingly economical and dependable is due in *no small measure* to the knowledge of these men in selecting the most suitable materials—their skill in processing and fabricating them by the most modern methods of manufacture—and their everlasting insistence on blue print accuracy at every stage of production.

Small wonder then, the awarding of a Quality Control Rating by the Armed Forces to this Division—thus confirming the full worth of Eclipse self-imposed standards of precision manufacturing.

And so if it's to meet today's demands or to aid in developing to-morrow's plans—bring your problem to Eclipse.

VITAL AVIATION ACCESSORIES—ENGINEERED AND BUILT WITH ECLIPSE CRAFTSMANSHIP

HASTEN COMPLETE VICTORY—BUY MORE WAR BONDS

PRODUCT OF

Bendix

AVIATION CORPORATION

(*Continued from page 80*)

are met full-scale production will begin. Republic also has plans for other additions "to fill out the line for private plane operators." This statement implies that the company will enter the medium-priced field with other designs. It is reported that the company plans a four-place, twin-boom pusher landplane.

RYAN AERONAUTICAL COMPANY, San Diego, Calif. More than most West Coast companies, Ryan is committed to heavy war production. T. Claude Ryan, president, has said, however, that he will re-enter the lightplane field after his military commitments are fulfilled. Ryan probably has engineers working on post-war planes.

SPARTAN AIRCRAFT COMPANY, Tulsa, Okla. Spartan has been heavily engaged in war work and has not made available much information on its immediate plans. The company plans quantity production of two all-metal planes. One would be a faster version of the four-to-five place Spartan *Executive* with fully retractable tricycle landing gear. The other is a twin-engined six- to eight-place airplane which could be used either on feeder lines or by business organizations and executives.

STINSON. See Consolidated Vultee Aircraft Corporation.

STOUT. See Consolidated Vultee Aircraft Corporation.

TAYLORCRAFT AVIATION CORPORATION, Alliance, O. Taylorcraft's main plant still is working night and day on fabricating military airplane parts, and the amount of labor available for commercial work is limited. Some is available, however, and is engaged in initial fabrication of Taylorcraft commercial fuselages, landing gears, and so forth at a leased branch plant. The labor situation, plus the flow of materials, will regulate private plane deliveries, but first production is expected in July or August and the company counts on being on a regular production basis before Christmas.

The company has facilities for producing 10,000 Taylorcrafts per year and is making its post-war plans on this basis. Orders now on hand exceed 4,700 planes —more than four times the best pre-war year. Company plans to limit its domestic representatives to 500.

Taylorcraft's first plane will be an up-to-date version of its pre-war 65-h.p. Model B side-by-side trainer under the designation Model B-1. The tandem trainer (Model D, commercial, Army designation L-2) will be discontinued. Second model to go into production will be the all-metal B-12C, a modernized version of the 65-h.p. Taylorcraft B-112 duotone deluxe, with a cabin 4½ inches wider and larger baggage space, new instrument panel and control wheels and other improvements. As soon as tooling can be completed, production will start on the 125-140-h.p. four-place Model 15. Tenative prices are $1,800 for the Model B-1, $2,500 for the B-12C and $3,500 to $4,000 for the Model 15.

TENNESSEE AIRCRAFT, INCORPORATED, Nashville, Tenn. General Aircraft, which no longer makes the *Skyfarer*, reports that Tennessee Aircraft has been organized to manufacture new versions of this non-spinnable two-control plane.

TIMM AIRCRAFT CORPORATION, Van Nuys, Calif. While Timm was rumored to be planning to build small planes with plastic bonded plywood fuselages, such as the Navy trainers they made early in the war, Otto W. Timm, president and chief engineer, reports that plans have not yet been completed. Timm seems to be adopting a "wait-and-see" attitude.

WACO AIRCRAFT COMPANY, Troy, O. Waco is "still at war" and has no information available on post-war plans.

ENGINE MANUFACTURERS

AIRCOOLED MOTORS CORPORATION, Syracuse, N. Y. Revocation of L-48 found Aircooled Motors with its post-war planning just completed. Production of commercial aircraft engines is expected to start during August and September on a limited scale and will accelerate with the decline of Government contracts and the increasing availability of materials. The company's post-war line has been completely re-engineered to improve operation and permit production economies.

The power-weight ratio of all models will have been materially improved. All engines will be of horizontally-opposed type, four to six cylinders, air-cooled, wet sump, through a power range of 65 to 200 h.p. Models for pusher and helicopter installations will be factory-equipped with a fan cooling system, the latter designed to operate in a vertical position. There will be four basic models. Prices will be low as or lower than pre-war prices. After VJ-day, additional advanced features will be installed and further production economies will be made.

CONTINENTAL MOTORS CORPORATION, Muskegon, Mich. The revocation of L-48 did not catch Continental unprepared. Most of the Continental engines are completely tooled for mass production and materials are being brought in to the factory in a continually swelling stream. The prospects for producing engines for civilian markets look exceptionally bright. Continental engines are now available in the following horsepower range from 65 to 500 h.p.: Model A65, 65-h.p.; C75, 75-h.p.; C86, 85-h.p.; A100, 100-h.p.; C115, 115-h.p.; C150, 150-h.p.; E165, 165-h.p.; E185, 185-h.p.; W670, 220 or 240-h.p.; R9-A, 500-h.p.; GR9-A, 500-h.p.

JACOBS AIRCRAFT ENGINE COMPANY, Pottstown, Pa. Jacobs has not yet made its production plans available.

KINNER MOTORS, INC., Glendale, Calif. Kinner is not yet ready to release data on its immediate aircraft engine program.

LYCOMING DIVISION of the Aviation Corporation, Williamsport, Pa., has not made available its present production plans.

RANGER AIRCRAFT ENGINES, division of Fairchild Engine and Airplane Corporation, Farmingdale, L. I., N. Y. Still fully employed in war work, Ranger is not planning to manufacture any new engines or any existing models in the immediate future, despite the revocation of L-48. However, Ranger is delivering Ranger Sixes completely reconditioned by the factory and sold with a Ranger guarantee. As an agent for the Components Disposal Section of the Surplus War Aircraft Division of DPC, Ranger is reconditioning for private use some of the thousands of engines it manufactured for the AAF training program. At present it has a bank of 1,500 engines to draw on for reconditioning. The first of the reconditioned engines have gone into Grumman *Widgeons*.

WARNER AIRCRAFT CORPORATION, Detroit, Mich. Though still busy with war production, Warner is now able to produce and deliver limited numbers of *Super Scarab* engines for commercial planes. As more materials become available for civilian production, full production is expected to be resumed in a short time. Warner will offer the *Super Scarab* Model 165, the seven-cylinder radial aircooled 165-h.p. engine used to power the Fairchild *Forwarder* and the *Super Scarab* Model 185, rated at 185 h.p. normal and 200-h.p. for take-off, which has been used on the Sikorsky R4 and R4B helicopters. Warner will continue to produce *Scarab* and *Super Scarab* 125- and 145-h.p. engines with spare parts and engines for servicing and replacement in planes manufactured prior to the war. END

15 YEARS AGO

FROM the August, 1930, issue of this magazine:

The Irwin *Meteorplane* FA-1 was being used to carry mail in Iceland, averaging 35 pounds per trip. A single-place biplane, it was powered with a 20-h.p. Irwin engine and sold for $1,165.

One airline was using the Fokker F-32, a high-wing monoplane, with a capacity of 32 passengers. It was powered with four Wright J-5 engines, two under each wing mounted back-to-back.

A story by Lieut. L. D. Webb on carrier-based aircraft, described the flotation bags which supported aircraft forced down at sea. Carriers then effected the rescue, using winch.

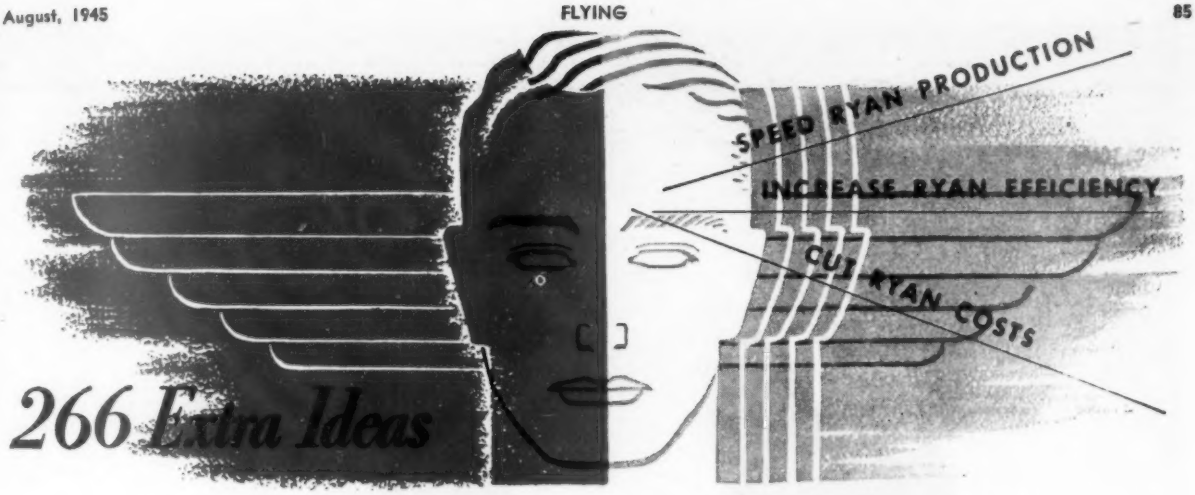
Z. D. Granville of Springfield, Mass., announced a "fool-proof" biplane known as the *Gee Bee*. The control stick was mounted horizontally under the control panel instead of vertically from the floor. Specifications: cruise, 95 m.p.h.; top speed, 107 m.p.h.; span, 29 feet; gross weight, 1,650 pounds.

Department of Commerce officials were striving for universal licensing of planes and pilots. The argument centered around eight states which had no licensing laws and in which rejected planes and pilots were operating.

Maurice Poirier proposed a tri-motored combined gas-engine and rocket transport plane. At high altitudes, rocket and jet-chambers would be released, making possible, Poirier said, speeds up to 1,000 m.p.h.

A plane with a circular, parasol wing, the angle of which was alterable in flight, was subjected to wind tunnel test by S. P. Nemeth, prominent aerodynamicist. Reports of technicians indicated the tests were successful.

Plane manufacturers asked engine builders to provide a supercharged engine to assure New York to Paris flights in from 12 to 15 hours using ordinary monoplanes fitted with extra fuel tanks.



RYAN'S Production and Engineering Staffs include many outstanding names of the aviation industry. But no one MAN... *nor one* GROUP... *has a monopoly on ideas. That's why the Ryan Aeronautical Company sponsors Shop Suggestion and Patent Development Plans, which offer valuable incentives to* ALL *employees...for turning in suggestions for improvements. Often, these suggestions turn out to be the sort which occur only to workers in their on-the-job, everyday experience. To date, Ryan employees have submitted 1065 ideas, from which have been obtained 266 valuable contributions to aircraft production. 266 reasons why Ryan production methods mean constantly improved military planes today...safer, lower cost air transportation tomorrow.*

NEW TOOL SAVES MAN-HOURS

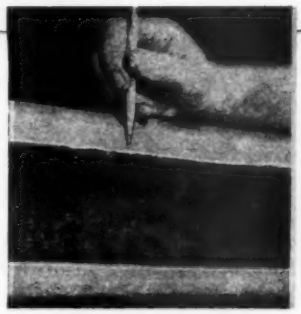
When the final section of metal skin is put down on a wing, there remains an overlap on the leading edge which must be trimmed back. The old method for doing this involved shearing off and filing the excess metal by hand. This was slow and produced an uneven edge. Glen L. Humphrey of Ryan's Final Assembly Department suggested mounting a motor-driven vixen file in a vertical position on a guide table, and using the edge of the spar as a guide. This idea not only stepped-up production by saving many man-hours, but produced a cleaner, more uniform trim.

– Shop Suggestion No. 433

NEW BRAKE-SHOE ELIMINATES BREAKDOWNS

Constant expanding and contracting of the circular brake-shoe on a Tannewitz Band Saw causes it to crystallize and break – frequently putting the band saw out of operation. Delmar Conde of Ryan's Mechanical Maintenance Department suggested making a brake-shoe in two separate halves, held together with helical springs, so that the shoe can be expanded without straining the metal. Result: costly, time-taking breakdowns caused by breaking shoes have been eliminated, and the production output of this important tool has been increased.

– Shop Suggestion No. 459



VULCANIZING DOUBLES LIFE OF SCARCE RUBBER

The rubber pad that covers the surface of a hydro-press ram is 6 inches thick and weighs several hundred pounds. Formerly, after both sides of the rubber had become badly chewed from forming metal parts, it was necessary to replace the pad with a new one. R. W. Booth, Sr., of Ryan's Drop Hammer Department, noting that the inner two-thirds of the pad was practically undamaged, suggested grinding off the outside inch of worn rubber from each side, and then vulcanizing an inch-thick layer of new rubber on each side. Result: pad's life is doubled.

– Shop Suggestion No. 1470

RELY ON RYAN TO BUILD WELL

1922-1945

RYAN *Airplanes*

Ryan Aeronautical Company, San Diego – Member, Aircraft War Production Council, Inc.

DESIGNERS AND BUILDERS OF NAVY FIGHTING PLANES AND EXHAUST MANIFOLD SYSTEMS

Did you say—
No servants' quarters?

Mrs. Pragbottom peered peevishly through her pince-nez at the postwar plane salesman.

But this was perfectly ridiculous . . . simply unspeakable! There were plenty of planes, of course, but such planes! That gorgeous pastel pink job with the dropped living room and the built-in bar would be grand but *so* tiny. And that beige and blue number with the penthouse was simply stunning . . . *but no servants' quarters!*

"Why," spluttered Mrs. Pragbottom, "it's practically prewar!"*

*Not quite, Mrs. Pragbottom, not quite prewar! But that postwar miracle plane you've set your heart on won't be here the day the Japanese are beaten. For a year or two, after the war, you won't see much difference between the prewar and postwar WACO. But keep your chins up, Mrs. Pragbottom. Prewar or postwar, WACO means comfort and stability . . . speed and safety for all-weather flying. WACO stands for *better* planes . . . for better flying. THE WACO AIRCRAFT COMPANY, 48 Peters Avenue, Troy, Ohio, U. S. A.

ALL ARMY CARGO-TRANSPORT GLIDERS ARE WACO DESIGNED

WACO AIRPLANES

Waco

IMAGINE your personal plane of tomorrow having—*automatically*—the extra get-up and go that today's military aircraft get from variable pitch propellers.

Actually, that's just what you can expect from the unique Aeromatic Propeller. Even under full load you'll have one-fourth shorter takeoff run, one-third higher rate of climb, greater cruising range and speed, all with minimum fuel consumption and engine wear! And you'll get long glides for happy landings—with instantaneous change of pitch for quick pickup if you overshoot the field.

This "propeller with a brain"—like no other propeller—is completely self-acting and self-contained. It automatically assumes the proper pitch for peak performance under any and all conditions of flight. You have no extra controls to fiddle with, no extra instruments to watch.

If you fly, or plan to fly, you'll want an Aeromatic Propeller on your plane. Write to your aircraft manufacturer about it today. And if you'd like our little get-acquainted folder containing a diagram of the "brain" in an Aeromatic Propeller, don't hesitate to write to: Aeromatic, 314 Scott Street, Baltimore 3, Md.

The Propeller with a Brain for Tomorrow's Plane

Aeromatic

Air Controlled *Automatic Propeller*

KOPPERS COMPANY, Inc., BARTLETT-HAYWARD DIVISION

Licensed under patents of EVEREL Propeller Corporation

Meet Captain Powers

(*Continued from page 29*)

the center of which I could hear the scream of the police car's tires and brakes.

Explaining the simple mechanics of his jeep-jet to me later, Powers off-handedly justified the use he had made of it:

"Police can never tell," he pointed out, "just when someone who really has a reason for running away will cook up a gadget like this. I simply remind the cops once in a while that they ought to learn to drive on instruments." I also learned that Powers keeps a record of all such traffic violations he makes and voluntarily pays fines on three per cent of them. That—as close as he could figure it—is the percentage of apprehensions which the police actually make in traffic violations.

That Powers is more famous for his flying than for his inventive genius is difficult to understand in light of his ATC record. But the fact remains that the most conservative of his friends wax a bit fanatical when they talk of his flying skill. Some of them concocted a song about him which was published recently in the Fifth Ferrying Group newspaper at Dallas, Tex. The song attributes his skill in flying to a father who "used to fly with hands for props" and a mother who "often jumped from silo tops."

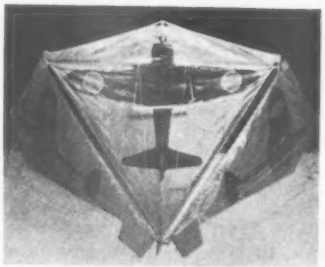
Mrs. Powers herself brands such accounts as "overdrawn," she insists that her son was not literally born an aviator. A motherly woman, Mrs. Powers is nonetheless firm in her insistence that Roger's first interest was in weather rather than flying. She'll tell you (with a twinkle in her eye) that when he was only two, Roger lassoed a cloud from his baby carriage and fashioned it into a teething ring. The cloud ring, together with a lock of Roger's hair, she insists, are today her most cherished mementos of his childhood.

More seriously—and a bit wistfully—she'll tell you that the babyhood of Roger Powers was all too brief. Roger's father exploited the boy's talents just as soon as they became evident. Thus, when Roger was three, the child became involved in one of the most amazing aviation achievements of recent years.

Mrs. Powers herself kept the facts concerning the extraordinary feat suppressed. Maybe that's the reason why some of the fantastic stories got started about the time Old Man Powers flew the Atlantic in a *Jenny*—which was all he could afford to buy at the time. Little Roger, so the story goes, had made an intensive study of clouds and among other things had discovered that if you press three or four cumulus clouds together (after squeezing the wind and thunder out of them) their solidity changes to that of a mattress—yet without loss of buoyancy. Roger rigged two such clouds and streamlined them (for a general picture of Young Roger's ideas about streamlining, see the Power's Models) and tied them on to his old man's Jenny. One cloud was loaded with extra fuel and they used the other for a combination landing field and bed.

However fantastic that story may sound, the facts may be even more difficult to accept. The Powers, senior and junior, did fly the Atlantic back in July, 1927—and in a plane that would require four mid-ocean refuelings going and four coming. How it was done will never be known for, when they got back, Mrs. Powers prevented her husband from publicizing the feat on the grounds that ballyhoo had ruined Lindberg's privacy and that Roger was too young for the limelight.

The more conservative insist that the intrepid flyers simply made use of an exceptionally strong tail-wind which virtually eliminated gas consumption on their transocean hop. Roger had pioneered in the study of wind currents.



TARGET KITE

FLOWN high from a ship's stern with a Japanese silhouette superimposed on it to simulate an attacking plane, target kites are now being used for Navy antiaircraft gunnery drills. This kite is approximately five feet long, although other sizes may be used depending on wind strength.

Developed by Comdr. Paul E. Garber of the special devices division of the Navy Bureau of Aeronautics, the target kite is equipped with a rudder giving the "kite pilot" unusual control. A skilled handler can make the kite do figure-eights, dive, zoom or skim the water and then whip into a climb, simulating a torpedo attack.

One story has it that, early in his boyhood, he made a pet of a tail-wind that followed him around for years until it ran out of blow. This wind, they say, figured prominently in a number of other aeronautical achievements. For instance, there was the time Roger loaned the tail-wind to Howard R. Hughes back in January, 1937, enabling Hughes to make a new west-to-east transcontinental record. Hard to believe?—both Hughes and the history books will testify that these are basic facts.

Scientific data gathered by Captain Powers for the Weather Bureau shows that, for most pilots, a pet tail-wind in good health picks up from 10 to 20 m.p.h. per year until it reaches its prime. Discovery of this basic phenomenon may explain a story once circulated to the effect that when Roger began to have trouble with his tail-wind he finally buttoned it into a big air pocket in the mid-Atlantic. And when it wiggled out of the pocket one day and went on a toot, the result was the New England hurricane which caused such fantastic damage.

Strange as all this may seem, Powers was responsible for one erroneous idea about the New England hurricane which may now be cleared up. Persons caught in the big blow thought that a peculiar noise made by the wind typified a special brand of hurricane. The fact is that the peculiar noise was Roger flying the storm—and in a borrowed plane. Whether he was rounding up his overgrown tail-wind or just flying for fun is matter for romantic conjecture. That he did fly the hurricane is easily documented—his was the only plane in the air at the time, and Powers himself will show you a copy of his flight plan.

Seasoned ATC pilots say that Powers still calls on his old friend, the tail-wind, in emergencies. An example they cite occurred on a recent flight Captain Powers led in the South Atlantic. The report on it comes to us from the navigator of one of the planes on the flight, as told to W/O James V. Lovell. W/O Lovell, stationed at Ferrying Division headquarters in Cincinnati, is a close personal friend of Powers and one of the world's outstanding authorities on Powersiana.

"An hour out of Ascension, one of those South Atlantic fronts suddenly enveloped us," the navigator reported. "We could have ditched, but the chances of survival were pretty slim. We did a 180° turn and after a few minutes did a 90°, then another. Frankly, we didn't know what was going to happen because we figured if we bored into the front the flight would be separated.

"Suddenly, the front split just like somebody had hacked it open with an ax. First time I had ever seen anything like that. There was Ascension dead ahead.

"Our co-pilot swears that he heard Captain Powers mumble into the mike, something that sounded like an order for a stiff, strong breeze to beat a path through the cloud mass."

The navigator, a lieutenant, added:

"The fans hadn't stopped turning after we were on the ground before everything closed in again, dark as night."

W/O Lovell is also our source of information concerning an equally dramatic incident in which Powers figured in the North Atlantic. He reports that he got his information from "a major of unquestioned veracity," leader of a flight of *Fortresses* being ferried to England.

"We were mushing along at 18,000 feet," the major reports, "when we broke into the clear. The temperature literally was less than nothing and tail assemblies were dragging in the slush. The top cloud layer was beginning to freeze solid, it was so cold."

Desperate, the major called Powers on the interplane radio to take over.

"I had hardly begun to speak to him before we got action," the major testifies,

Folks who'll fly tomorrow...

"Have You Heard the one about the flying salesman and the Cessna? That's me, postwar. I'll cover my territory in ½ to ⅓ the time... see three times as many customers. I used to spend most of my trip time coming and going. But in my Cessna, I'll double my sales, at least, by getting there sooner and oftener!"

"At the Drop of a Hat, I have to travel the country over to keep ahead of the trend in gowns, suits, accessories. From New York to Mexico or Hollywood, wherever style ideas are budding, that's where I have to be. And you can bet your last pair of Nylons, I'll be scooping the fashion world when I'm flying my own Cessna!"

and why they will CHOOSE CESSNA!

BOEING B-29 SUPERFORTRESS

SISTERS UNDER THE SKIN... Your Personal Plane and the Boeing B-29. If you're planning to fly your own plane postwar, stop and look twice at this Boeing B-29.

Look at that huge vertical fin. In spite of its size, it is made with such accuracy that spare fins may be sent to bases where the giant bombers are repaired with the assurance that they will fit to a "T." And these fins, as well as 18 other important parts for B-29's, are being precision-built at Cessna, by the same men who will build your personal plane.

The knowledge of all-metal, precision work that Cessna men have gained through these war years is your promise that your postwar Cessna will be *more airplane for your money*. So, when the time comes for you to try your wings, choose your Family Car of the Air from the complete line of Cessnas... all *Cessna-Engineered for Safety*.

CESSNA AIRCRAFT COMPANY
Box 1616-F, Wichita, Kansas

Cessna

THREE TIMES JUDGED "THE WORLD'S MOST EFFICIENT AIRPLANE"

"and the neatest thing about the job was the drop of five yards a mile in the path Captain Powers cleared. We literally tobogganed all the way into England."

His legendary fame as a pilot and weather expert have perhaps overshadowed one of the most earthy aspects of the Powers personality—his ability as a mechanic. As a small boy, Powers was allergic to this aspect of his profession, on moral grounds. Of his early flights, to quote from the Fifth Group song,

"He did all this without Curtiss-Wright
'Cause he always sneered at engines in flight.
'That's kind of cheaty,' young Rogers said,
'I'd much rather overhand crawl instead.'"

It follows that what little mechanical prowess he developed, he came by the hard way. His achievements in this department were not without merit, however. His uncanny knowledge of aircraft equipment, some say, comes from his long practice of thinking of himself as a physical counterpart of each unit of his plane. He was only nine, they relate, when, flying with his father one day one of the wheels fell off the Jenny. Fearing that if he landed without both wheels his prized plane would be wrecked, Old Man Powers was practically in tears. But not little Roger. Pressing his lips tightly together in a great resolve, he climbed down and doubled up around the empty axle and signalled the Old Man to take her in. After some hesitation, the father obeyed. That he escaped with only minor bruises and a crick in his back seems miraculous. But the facts are that both Powers and the Jenny are still in operation today despite that wheel-less landing.

More recently, Captain Powers has evinced considerable interest in remote-control developments. There are rumors that a few weeks ago he flew a couple of *Skymasters* side by side, standing on the wing-tips and operating the planes with his remote control device—a radio-electronic finger-tip gadget.

How simple facts hinted at in a report of this kind can be distorted is evidenced in a story currently in circulation. It is related that in order not to be blown from the wings, Powers strapped his feet on fast to the wing tips—a precaution which resulted in a peculiar accident. One of the planes hit a down-draft, stretching Roger's left leg about a quarter of a mile longer than the right. Despite considerable pain, Roger landed the *Skymaster* hitched to the longer leg, kicked his foot loose, circled, and landed the other.

Stretching the truth still further, some report that on the second landing he held the long leg stretched in front of him to avoid further injury. This led to another complication, since he inadvertently kicked the teeth out of a colonel who was watching the operation from the edge of the field.

Getting down to what is actually known, however, it is true that Powers is in a recuperative hospital in the Alps, where (by his own cabled report) he is walking on mountainsides in an effort to expedite his recovery from a leg injury. We do know, too, that the Air Surgeon's office took a scientific interest in that injury. Other than that, the unfortunate loss of a certain colonel's teeth has kept the whole affair a military secret.

Captain Powers' personal modesty has carried over into his public career and he has consistently refused higher rank. He is a "Class-5 pilot," qualifying him to fly any model of aircraft produced by U. S. manufacturers. This ability got him briefly into combat early in the war. Having delivered a *Lightning* to the African theater, he wangled a combat outfit into letting him fly it into German territory. He lost the P-38, but brought back the first Messerschmitt Me-109 to be captured intact. He refuses to tell how he did it, but friends insist that he got over the Messerschmitt and jumped from his plane to the enemy's, landing astride the fuselage just behind the cockpit. In any event, Powers brought in an astounded German pilot, plane and all, at the point of a service revolver.

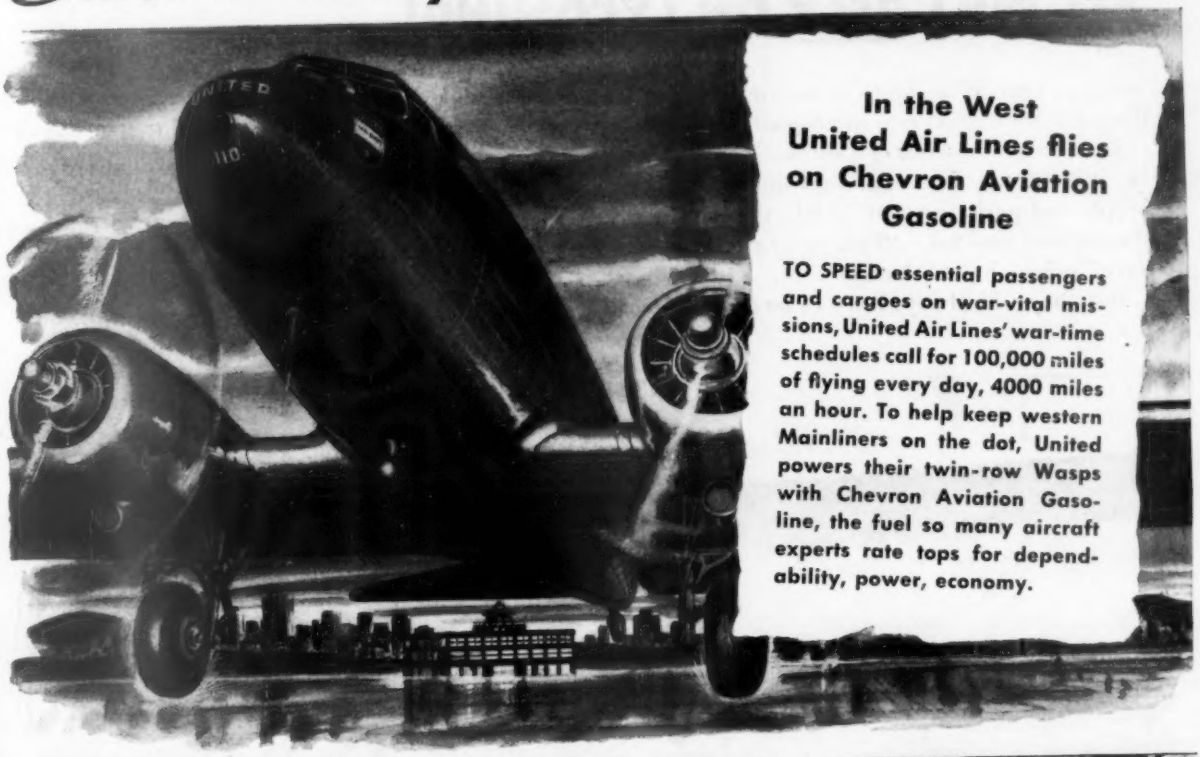
Though extremely modest, Captain Powers is a stickler for accuracy. He was particularly critical of a pilot who recently transferred to the Ferrying Division's 3rd OTU at Reno, Nev., after a year of flying the Hump.

One afternoon last January—so the pilot told W/O Lovell—a converted *Lib*, loaded to capacity with a cargo of fuel, was laboring over the Hump when a Jap fighter plane popped into view at 12 o'clock. Crew of the transport thought of their inflammable cargo and bemoaned their fate. Suddenly, just as the Jap maneuvered into position for a pass, a *Warhawk* swooped out of the clouds in an inverted power dive. With exquisite timing, the P-40 pilot came in just over the Jap pilot's head and knocked him out with a fire extinguisher. The Nip fighter promptly went out of control and crashed into a mountainside.

"I remember the incident distinctly," says Captain Powers. "I had borrowed the P-40 and picked off Zeros until I ran out of ammo. I was returning to the base when I saw the *Lib* helpless in the path of the Jap fighter. Up to that point, everything tallies with the facts." At this point he frowned. "But I didn't hit the Jap with a fire extinguisher," he concluded indignantly. "It was a beer bottle."

It was only with the greatest difficulty that FLYING *was able to compile these facts about the Paul Bunyan of the Air Transport Command. However, we will welcome additional information from readers who may know of some of Powers' other exploits.*—ED.

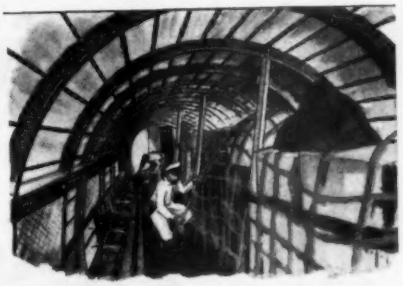
Stars in the sky.... *United Mainliners*



In the West United Air Lines flies on Chevron Aviation Gasoline

TO SPEED essential passengers and cargoes on war-vital missions, United Air Lines' war-time schedules call for 100,000 miles of flying every day, 4000 miles an hour. To help keep western Mainliners on the dot, United powers their twin-row Wasps with Chevron Aviation Gasoline, the fuel so many aircraft experts rate tops for dependability, power, economy.

POST-WAR SKIES will see fleets of four- and five-mile-a-minute DC-4's and DC-6's flying for United. Low detonation characteristics of Chevron Aviation Gasoline will permit top power output from their big engines. Economy of Chevron Aviation Gasoline will put more flying hours into their 2880-gallon fuel tanks.



CARGOLINERS, DC-3's converted into flying freight cars, speed shipments from coast-to-coast overnight. All-cargo flights are one of many United innovations in the 17 years it has used Standard aviation products.

"COMFORTIZER" to heat or cool Mainliners before take-off is an example of United's careful attention to passenger comfort and operating efficiency. United Air Lines use of dependable flying fuel like Chevron Aviation Gasoline is another.

Standard and United engineers collaborate on flying fuel tests.

AIRLINE CAPTAINS, test pilots, combat fliers say Chevron Aviation Gasoline brings out the best in any aircraft. Try it in your personal plane—Chevron will make it, too, a star in the sky.

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AVIATION
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STANDARD
OF CALIFORNIA
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Littletown...Middletown...and Bigtown, too...

ALL WILL RELY ON LYCOMING!

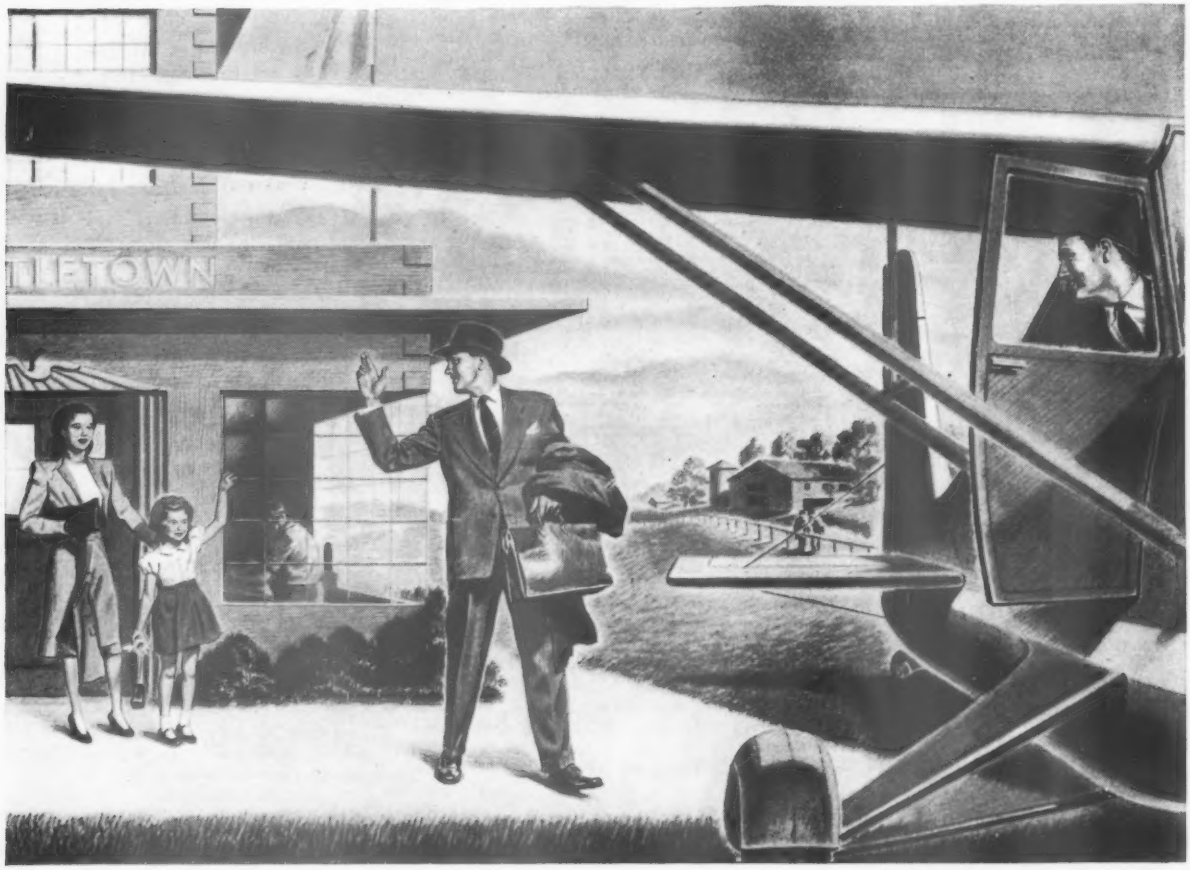
Sure . . . great new giants of the air will span oceans and shrink the earth from great new metropolitan airports after the war . . .

But tens of thousands of "workhorse planes" will be in there, too! From hundreds of small and medium airfields they'll pick up the people and packages that "feed" the main airlines. They won't always land and take off on super-runways. They won't always have "prima donna" hangar care.

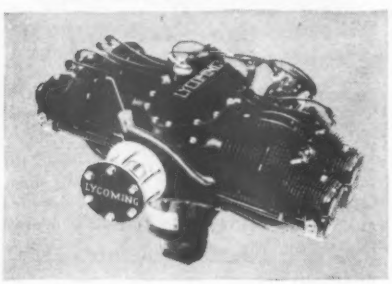
But they will always have to be *dependable*. . . .

So you know LYCOMINGS will be there! All over the world, Lycoming's special knack for ruggedness, economy, easy maintenance . . . for *dependability* . . . will help make the air world safe and sure.

Dependability will be the backbone of the air world. Dependability has *always* been the business and the pride of LYCOMING!



LYCOMING, MODEL O-145
DEVELOPING 65 H.P. AT 2550 RPM.



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AIRCRAFT ENGINES . . . 55-300 H. P.

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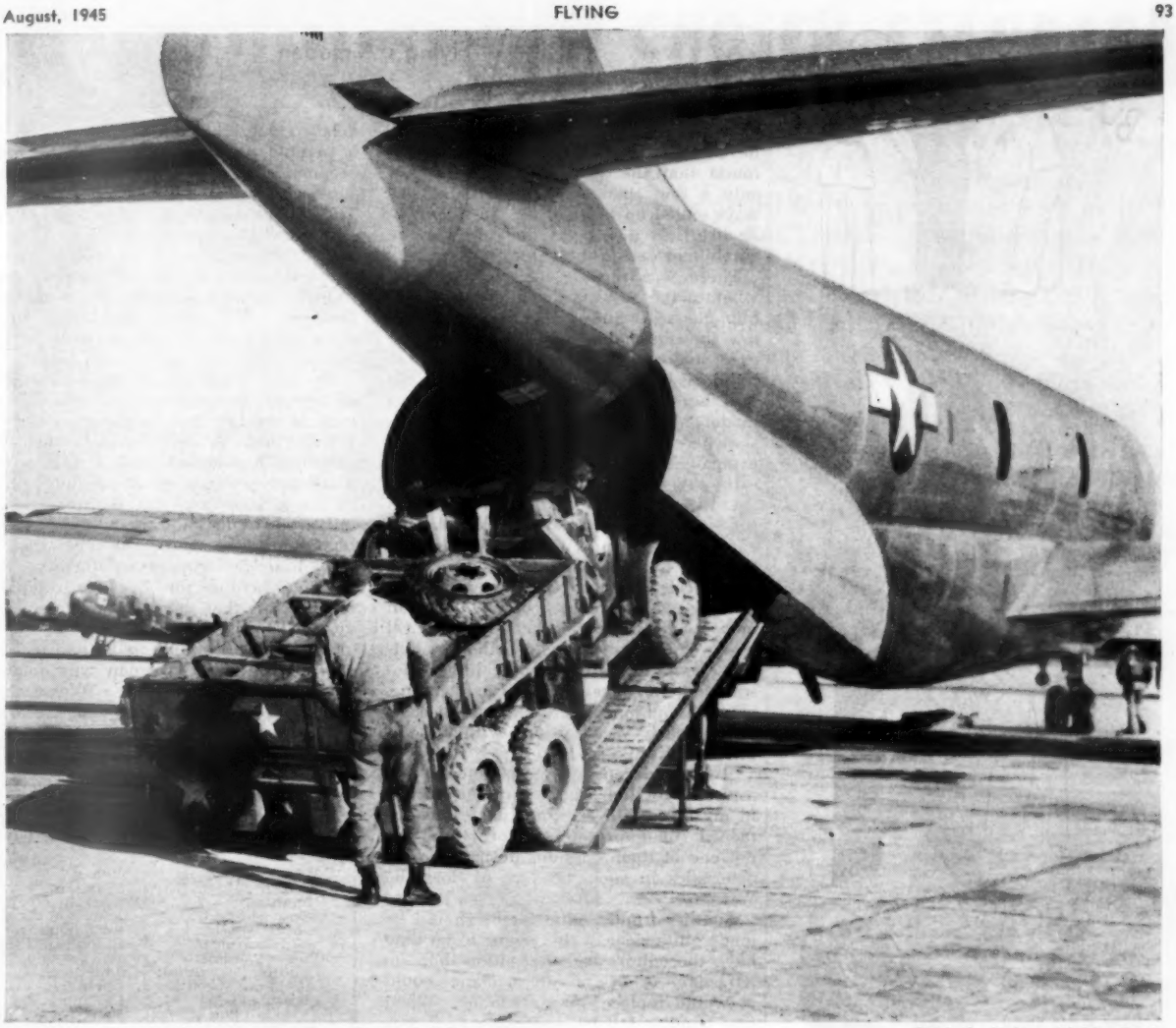
POWERED BY LYCOMING — THE ENGINE WITH A PROVEN PAST AND A SURE FUTURE



Army Ground Forces airborne troops loading a Boeing C-97 Transport

Finish the Fight – with War Bonds

Super-transport

The new Boeing C-97 Army Transport, military version of the mighty Stratocruiser, has already made world headlines by its record-shattering coast-to-coast flight. Crossing the continent at an average speed of 383 miles per hour is big news. But there are other facts about this versatile airplane that are just as startling. Among them are *payload capacity and low operating cost.*

In post-war service the Boeing Stratocruiser, accommodating 72 to 108 passengers, will make possible more comfort, safety and economy for air travelers. Cross-continent delivery of "red-ball" freight on a one-day schedule can also be regular procedure. And both fares and cargo rates can be reduced. High cruising speed, great carrying capacity and ease of loading and maintenance give the Stratocruiser amazingly low direct operating costs.

As a military transport, the C-97 can carry 120 fully armed troops; or several score litter cases with medical attendants; or two medium-size trucks, plus other cargo. Furthermore, the trucks can drive right in, using a built-in ramp at the rear of the plane.

Special equipment cuts loading time to a minimum. The airplane's self-contained electric power-hoist picks up heavy freight and positions it wherever wanted in the upper deck. At the same time, the two lower-deck compartments can be loaded through side doors.

The aerodynamic advancements built into this first true super-transport of the future are the result of Boeing's long experience in the design and production of four-engine aircraft—the Flying Fortress and Superfortress—the Boeing Stratoliners operated by TWA and Pan American, and the Pan American transocean Clippers.

After victory, Boeing leadership in research, design, engineering and manufacture will bring you the Stratocruiser and other forward strides in air transport. You can be sure . . . if it's "Built by Boeing" it's out in front.

DESIGNERS OF THE B-29 SUPERFORTRESS • THE FLYING FORTRESS • THE NEW STRATOCRUISER
THE KAYDET TRAINER • THE STRATOLINER • PAN AMERICAN CLIPPERS **BOEING**

Flying's Airsedan

(Continued from page 34)

place amphibian. Using what were believed to be the best compromises, it was found that the amphibian design—with only a few changes in appearance—always ended up looking like the Republic *Seabee*. So it was decided to drop the amphibian design altogether.

There was considerable debate as to whether the *Airsedan* should be two- or four-place. It finally was decided to follow the automobile industry in that the great majority of automobiles sold to the public is in the sedan classification. It was agreed, though, that a two-place model also would be desirable; it is sketched on the back of the gatefold accompanying this article.

If any one existing airplane design could be said to have influenced the final concept of the *Airsedan*, it would be the experimental Weick W-1 and W-1A of the late 1930's. Those experimental aircraft, when tested by the NACA and the Bureau of Air Commerce (now CAA), had many of the virtues sought in the ideal post-war private plane: excellent visibility, maximum safety, non-stalling, non-spinning, remarkable low-speed landing, take-off, and maneuverability. In discussing the early Weick design with the editors, Mr. Kotula said:

"I have dozens of reasonable-looking aspirants for the private airplane market in my files, with all kinds of devices attached for improving performance, but not one of them contains desirable characteristics in such measure as does the W-1."

Another fundamental factor should be made quite clear at this point: at no time have the editors had the notion that the *Airsedan*—or *any* private airplane—could or would replace the automobile. When that popular fallacy was explored it was proved to be economically unsound. Some time ago T. P. Wright, now head of the CAA, surveyed the cost of manufacturing small airplanes. At that time he found that a four-place plane, weighing 1,450 pounds empty and produced at a rate of 10,000 units a year, would sell for $1.90 per pound. On that basis the four-place *Airsedan* would be priced at $2,850 —*if sold at a rate of 10,000 annually.* That, of course, far exceeds the price of any comparable popular automobile.

It was on this foundation, then, that the final conception of the *Airsedan* was based. Every feature of the FLYING design then was worked over separately before it was incorporated in the finished *Airsedan*. How this was done will be described in the remainder of this article.

WING. It is believed that a relatively high-lift wing now can be expected on advanced private aircraft designs. Such an airfoil has been incorporated in the *Airsedan*, giving it a wing loading of 13 lbs. per sq. ft. at gross weight. High-lift wings have already been tested on certain experimental lightplanes and, it is reported, their past deficiency in lateral stability and control has been overcome. Of course, the *Airsedan's* flap had much to do with the selection of the type of wing. The actual shape of the wing was debated, largely from the point of view of manufacturing costs. Perhaps the most economical shape would be along the squared lines of most Grumman wings. The square wing tips and straight edges undoubtedly could be atttractively designed, although from the standpoint of sheer appearance and "eye-appeal" the rounded tip and tapered wing would be desirable. Yet, wind tunnel tests have shown the squared wing equally as efficient.

The high wing was chosen as the best all-around compromise, particularly in view of the fact that maximum visibility is important. A shoulder-high wing was seriously considered, but a number of disadvantages—concerned mainly with its installation and the position of the tail group—ruled it out in favor of the high cantilever wing. The main spar of the *Airsedan* wing runs through the fuselage behind the baggage compartment. Note that the twin tail booms are attached to the center section.

The *Airsedan's* wing folds; that feature is based on the Grumman wing-folding design, greatly simplified. It would be hand-operated. The folded wing is shown on the front of the gatefold, in the strip along the top. In the center sketch, note the detachable rod, from tail boom to the ground, to hold the *Airsedan's* tail upright when the wing is folded.

AIRSEDAN DATA

Engine: one 150-h.p. air-cooled, six-cylinder opposed.
Accommodations: one pilot, three passengers.

Wing span:	40 feet
Length:	25 ft. 6 in.
Height:	8 ft. 6 in.
Gross weight:	2,600 pounds
Empty weight:	1,500 pounds
Wing loading:	13 lbs./sq. ft.
Power loading:	17.3 lbs./h.p.
Landing gear tread:	9 feet
Maximum speed:	135 m.p.h.
Cruising speed:	120 m.p.h.
Level landing speed:	50 m.p.h.
Stalling speed (tail down):	40 m.p.h.
Maximum range:	480 miles
Service ceiling:	15,000 feet

FLAP. Extensive investigation was conducted before the *Airsedan's* present flap was selected. Inasmuch as the flap had much to do with the selection of the wing, the research into the whole field of the wing flap was exhaustive. The conventional, simple flap (like those on the Stinson *Voyager*, Ryan *Recruit*, etc.) was ruled out because of the need for a higher-than-usual wing loading. The simple flap falls off in efficiency beyond an angle of 40°. The NACA slotted flap increases that angle to 45°, giving from 10 to 20 per cent more lift over the flap. Perhaps the best flap actually in wide use, though, is the double slotted flap of the Douglas *Invader* attack bomber. It gives a maximum angle of 52° and another 10 to 20 per cent increase in lift over the NACA flap. Thus, the airplane equipped with this flap gets higher level-flight speed and the same landing speed, with smaller wing area. One other flap

Commando

CHOSEN STANDARD TROOP CARRIER . . .

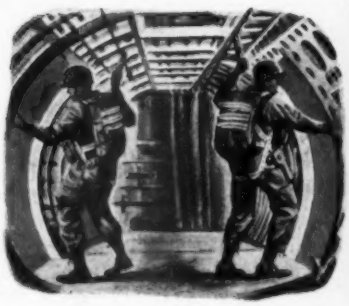
Long famed for their prodigious work as Himalayan "Hump Run" haulers, C-46 Commandos have been chosen the standard aircraft of the Troop Carrier Command. In their initial action, they precipitated paratroopers onto the German plain in the first Allied aerial crossing of the Rhine.

LONG RANGE— DOUBLE FIGHTING PUNCH

With an 1800 mile range and 36 paratrooper capacity, Commandos revolutionized airborne operations by doubling the fire and fighting power any previous American transport ever carried into action.

DOUBLE JUMP DOORS

New, double paratrooper doors on the C-46 enable simultaneous unloading from both sides of the plane. More troops can be spilled into a smaller area, can more quickly assemble in strength for strong surprise land attacks.



REPLACEMENTS BEING C-46 TRAINED

All future troop carrier replacements will be trained for C-46 Commando operations. Transition training has already been given units overseas. This world's largest and fastest twin-engine transport is destined to play a part of increasing importance in America's expanding aerial warfare.

CAN TOW GLIDERS

Its ability to tow all types of gliders from the CG-4 to the newest, largest CG-70 "Trojan Horse", plus its greater power and range make the Commando ideally practical for the longer reaches of the Pacific war theater where the C-46 is destined to see plenty of action.

CURTISS AIRPLANES
DIVISION OF
CURTISS-WRIGHT
FIRST IN FLIGHT

Printed in U. S. A.

U. S. Navy's Grumman Hellcats "On Target"

Grumman

AIRCRAFT ENGINEERING CORPORATION, Bethpage, L. I., N. Y.

also seemed worthy of *Airsedan* consideration. It is the Grant slotted flap with slot controller. Among other things, the Grant flap gives a landing speed of 31 m.p.h. at a wing loading of 10 lbs. per sq. ft. This flap has been developed and tested for a large aircraft manufacturer.

The *Airsedan* flap is a compromise between the Douglas and Grant flaps. It is recognized, of course, that both these flaps are complex and expensive in their present forms. But a check with engineers of the manufacturers now using them indicates definite promise for the near future. Both flaps can conceivably be simplified for lightplane use.

ENGINE. Several air-cooled six-cylinder opposed engines of the required 150 h.p. are available for the *Airsedan*. Their performance can be further increased by a simple, reliable two-position propeller, although present-day prices of such propellers are prohibitive. It may also be that the *Airsedan's* engine might be modified to include an overdrive gear so as to increase take-off performance. Of course, the engine must include an electric starter and generator as standard equipment; the day of the hand-cranked propeller has passed.

CABIN. Here we have followed quite closely the trends of the automobile industry. Comfort and eye-appeal are all-important. The seats are intended to be the most practical, yet comforable design for cross-country travel. It seems practical, too, that each seat position be equipped with shoulder straps and safety belt, instead of the present single safety belt. There is one large door on each side of the cabin; each has a hand-cranked window. Rear windows can be opened partially.

The underseat heater is another idea borrowed from the automobile designers. It distributes heat evenly throughout the cabin, and also is attached to the windshield defrosters.

The windshield itself was given particularly careful consideration. An almost universal complaint among pilots is the poor visibility of most present-day plastic windshields, especially after they have been used for some time. Either one of the newer, harder plastics would be used in the *Airsedan* windshield or, possibly, thin, lightweight safety plate glass panels.

The large transparent panels above the occupants of the front seat gives maximum visibility above and, with the aid of the built-in wide-angle mirror, to the rear. A simple system of sliding sun shades would cover these panels when needed.

Note the folding map desk built into the door on the pilot's side. This would pull down over the pilot's lap, and would have simple attachments for holding maps in place for cross-country flying.

CONTROLS. Dual control wheels were seriously considered for some time. But it was decided that the *Airsedan* should be designed as a transport vehicle for the private pilot, and should not stress the requirements of a trainer. It was recognized, however, that the person in the right-hand front seat often likes to "spell" the pilot. Hence the throw-over wheel in the *Airsedan*. Elimination of the throw-over feature—automobiles are not dual-controlled—would save weight and greatly simplify that control's mechanism.

The *Airsedan* is two-control, hence has no rudder pedals. The pilot uses his feet only to operate the foot brake for maneuvering on the ground. The hand parking brake overrides the foot brake, locking it in place when the hand mechanism is pulled up.

The flap-operating lever projects forward between the two front-seat occupants.

Locating the throttle on the control wheel is the result of a determined effort to get the present long, protruding knob out of the way once and for all. A modification of the old Model T Ford hand throttle seems to offer the most interesting possibilities. It would have the added advantage of being easily accessible, enabling the pilot to keep both hands on the wheel while operating the throttle.

LANDING GEAR. First instinct, of course, was to equip the *Airsedan* with a simple retractable landing gear. Every possible idea was explored, but always with the same conclusion: the *Airsedan's* undercarriage should logically, economically remain fixed. It was found, too, that a well-designed fixed gear offered much less resistance than would be imagined. A number of pilots—most of them currently flying large aircraft with retractable gear—indicated a preference for a clean, simple, fixed gear on their low-horsepower personal airplane.

The *Airsedan's* fixed tricycle gear has two main cantilever legs much like those of the Stinson *Voyager*. The nose wheel

MALLDRILLS pack the wallop that counts in heavy production or general maintenance work . . .

★ Rugged construction for long, hard, continuous drilling of metal, plastics and wood.

★ Special steel alloy gears and self-lubricating bearings assure increased speed, cool operation, and long service.

★ Light weight and compact design reduce worker fatigue. Also add to adaptability of drills.

★ Easily serviced—commutator can be inspected and brushes replaced without dismantling drill.

★ ¼" and ½" capacity models are available for 110-volt A.C. or D.C. or 220-volt A.C. or D.C.

★ Available on suitable priority.

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is steerable. None of the wheels have streamlining pants; they do not streamline as much as some people think, and they do collect mud, snow and ice, which make for ground accidents.

There is a light "bumper" built into the bottom of each vertical tail fin, in the event of inadvertent tail-down landings.

ROADABILITY. Dozens of experts favor the roadable private plane. FLYING devoted much study to this feature—then discarded it. The consensus is that a safe, economical and efficient airplane will have to be an airplane and nothing else. Such an airplane cannot be expected to be an automobile in its spare time, any more than an automobile should be expected to fly. For some highly specialized, restricted purpose—as in the case of the amphibious jeep—such a misfit can be justified. But it is quickly recognized that, in the case of the amphibious jeep, for instance, it is neither the best possible jeep nor the best possible boat.

It was decided, then, to make the *Airsedan* the best possible *airplane* for the purpose, to the exclusion of such handicaps as the gears, transmission, and added weight that would go with roadability.

JET-ASSISTED TAKE-OFF. For emergency use only, this device should be relatively simple to include on the *Airsedan*. Jato cartridges now used by military aircraft develop the equivalent of 300 h.p. each. A simple, lightweight cartridge could well be developed for emergency take-offs. It could be inserted quickly and easily in a simple receptacle at the rear of the *Airsedan's* fuselage, under the engine and directly behind the landing gear legs. Jato already has been tried experimentally on a lightplane. One of the first Jato take-offs was made at March Field, Calif., on August 6, 1941, with a Jato-equipped *Ercoupe*. It has been found that Jato cuts down the take-off run of present-day craft as much as 60 per cent.

This is the *Airsedan* as we now visualize it. Dozens of modifications of its many features can, of course, be made. The folding wing may not be as important as is presently indicated; its elimination would cut down considerably the production cost of the *Airsedan*. Any combination of instruments and radio can be had, these too having an important bearing on the *Airsedan's* selling price.

But the editors feel that the *Airsedan* is basically the kind of post-war private airplane the buyer has a right to expect. It is not a radical departure from all known practices, nor is it a 1930 design with a new paint job. It is what we hamhanded amateurs might buy to the exclusion of that new car, deep-freezer, new radio, or air-conditioning unit for which we are so anxiously waiting at the moment. END

Mid-Air Collisions

(*Continued from page 48*)

the 31 mid-air crashes which occurred in 1943, pilots had violated the Civil Air Regulations, bolsters CAA's claim that adherence to these regulations will prevent accidents. Much of the danger is removed from even the most hazardous of maneuvers if proper procedure is observed. Actually, the three maneuvers considered most hazardous—instrument flight landings, forced landings and night landings—contributed only one crash in each category during 1943, adding only two fatalities to that year's toll.

In contrast, 1943 saw more persons killed or seriously injured in collisions that occurred on clear days during routine landing approaches than in any other category. Roscoe B. Bancroft of the CAA says:

"Analysis of such collisions indicates the following errors: pilot failure to spot all aircraft in the landing pattern, violation of the safety rule which provides for a 1,000-foot straight approach, and failure to clear areas blanked out by the wings during pattern turns.

"It is natural," Bancroft continues, "for pilots to strive for smooth approaches and landings. They dislike any disturbance of their glide after they are properly squared away to land. Such a desire must be subordinated, however, whenever a properly co-ordinated "clearing roll" will assure a relatively safer position with respect to other aircraft. Final landing approaches involve precision planning, observance of ground traffic, contact with the control tower, and adjustment of landing gear and other controls, as well as a close check on traffic within the pattern. Forty per cent of mid-air crashes of the past five years occurred during final approach—a definite indication of where the greatest pilot alertness is required."

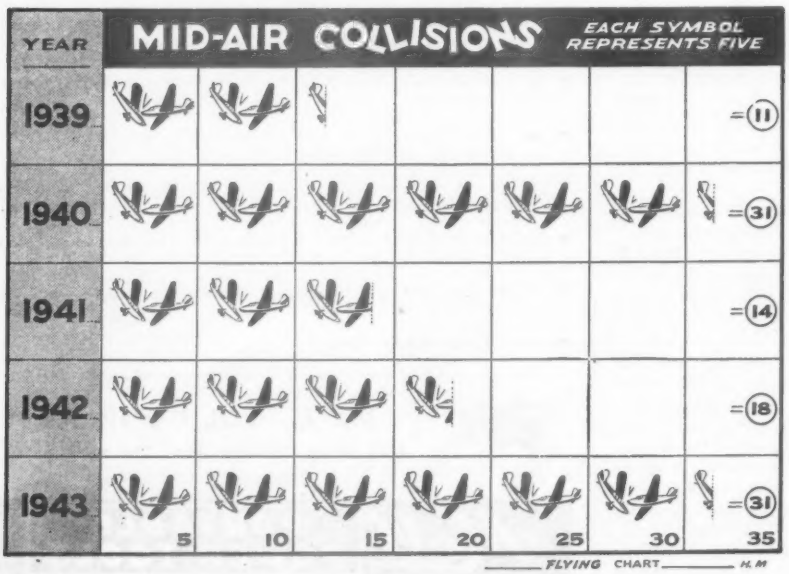
Roughly, about 10 per cent of mid-air collisions occur during exhibition flights—flights in which the pilots attempt to exhibit their skill in impromptu air shows. On one such occasion, experimenting pilots attempted a night formation flight, flying their four planes in the usual diamond pattern. During the course of the flight, the pilot on the right inadvertently doused his navigation lights. Tail-end Charlie thought (when the lights went out) that his friend had dropped from formation. He moved up into what he believed was a vacant position. As he drew up, he saw the dim outline of the unlighted plane and pulled sharply to the left, smashing into the plane riding in No. 2 position and sending it spinning to the ground. Two men were killed.

Another such accident took a toll of four lives—three servicemen and one civilian. Home on furlough, the servicemen decided to visit the local airport and do some formation flying. They picked up an airport employee, divided into groups of two, rented a *Cub* and a Luscombe and took off. They were observed flying close formation at altitudes of less than 500 feet. Somewhere along the way they tightened the formation too much. The planes crashed and plummeted to the ground, killing all four flyers. Regardless of what the CAA can accomplish with its new safety program, there is little hope of preventing accidents when pilots fly formation in planes of unlike speeds.

Less than three per cent of in-flight accidents occur while pilots are entering traffic patterns. But the number is sufficient to indicate that lack of uniformity of airport patterns is the confusing factor in this type of crash. As long as some fields use a left-hand pattern, others a right-hand, and still others use both right and left under varying conditions, it is essential that pilots know the procedures at each field they frequent. At unfamiliar ports one should study the flight pattern well, never assuming that observation of standard flight rules will suffice.

A case in point is the story of an in-

(*Continued on page 102*)



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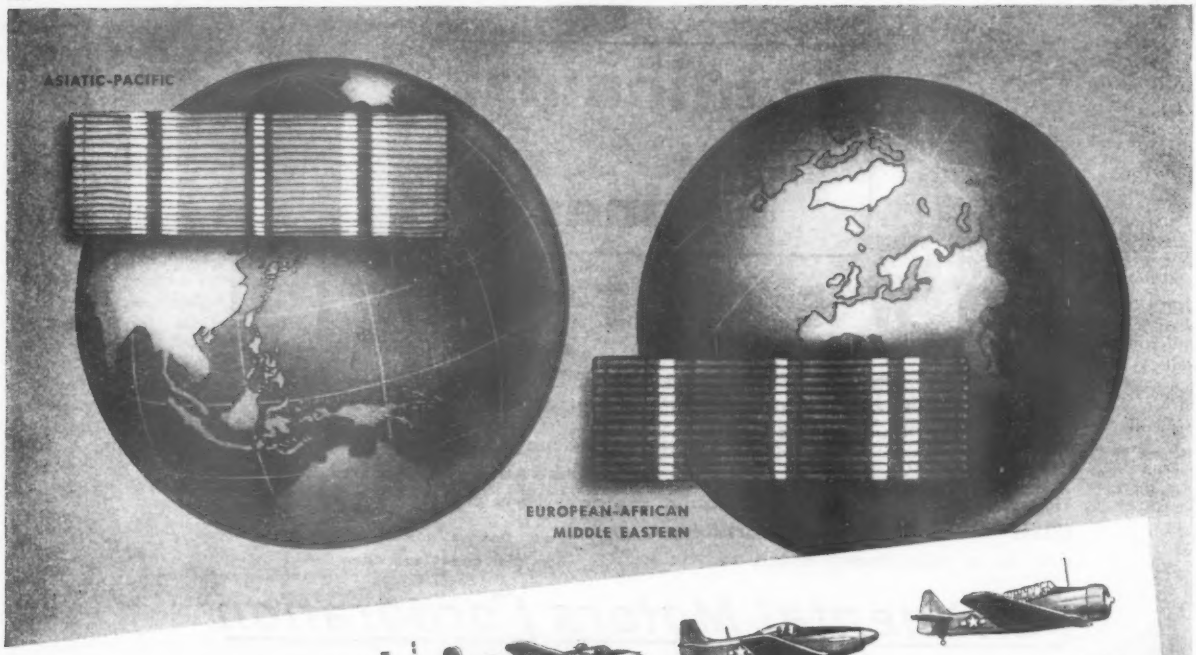

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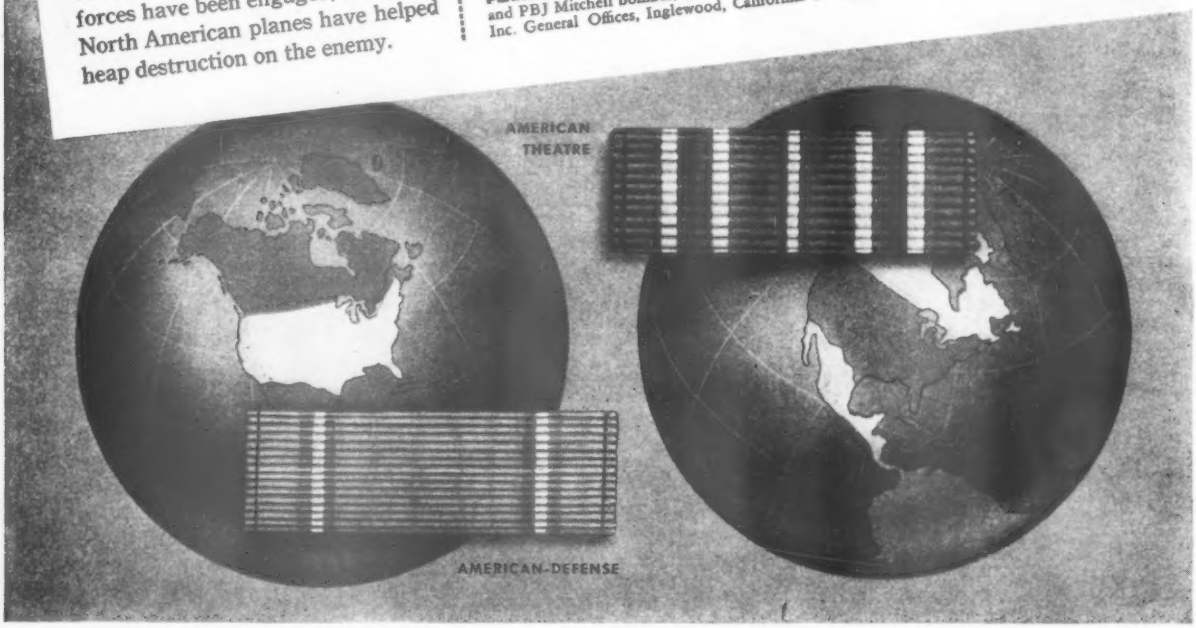

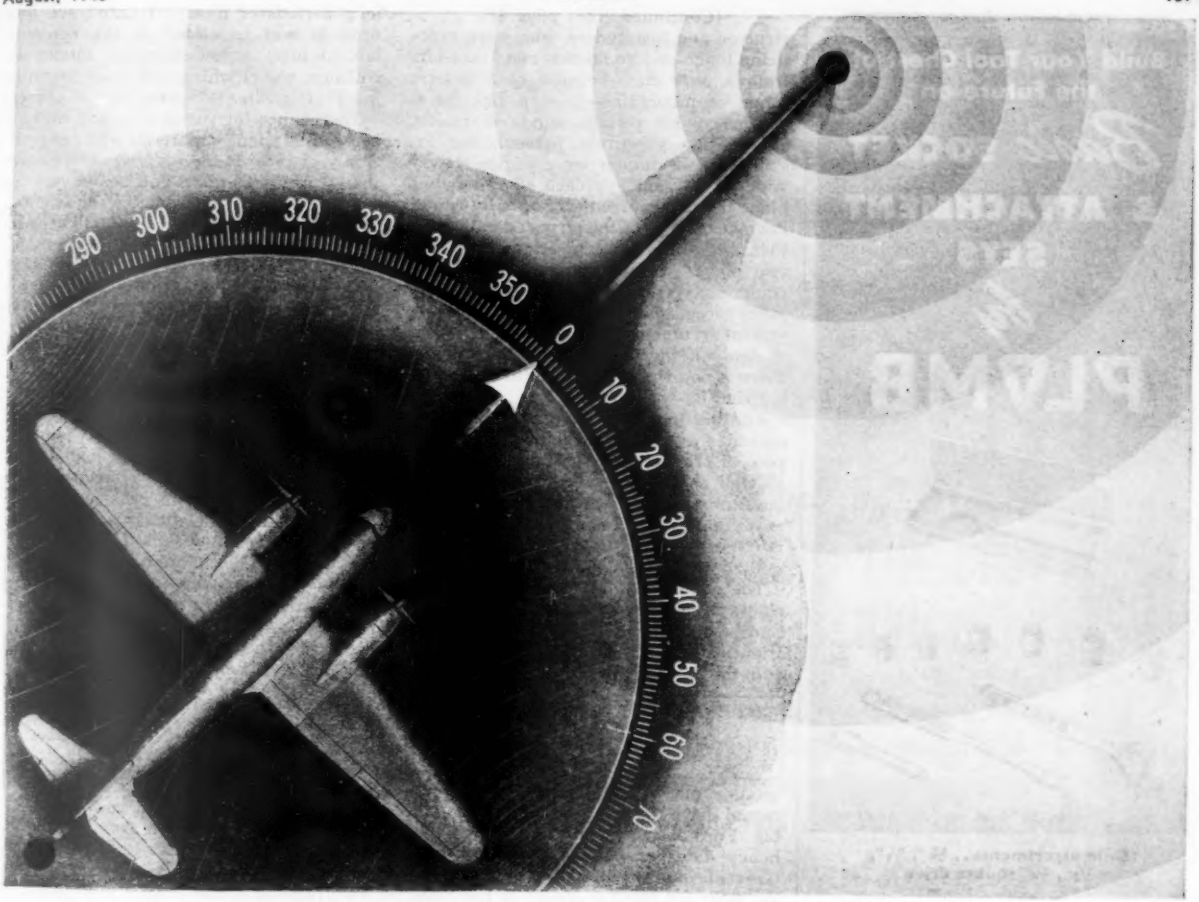

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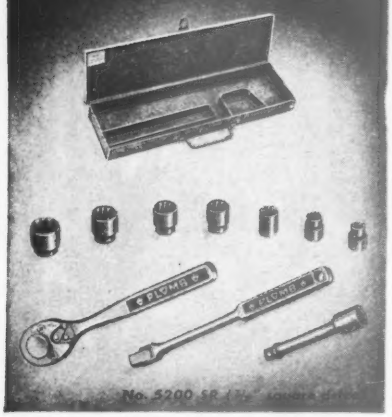

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FINE HAND TOOLS

(*Continued from page 98*)

structor and his student who were practicing touch-and-go landings and take-offs from a port that—because of a nearby range of mountains—used a right-hand pattern under certain wind conditions. Flying this substitute pattern, the instructor and student were on the downwind leg of their approach when another plane flying a course that normally would have been clear of the airport's traffic met them head-on. The four occupants of the two planes were killed in a crash that could have been avoided had either of the pilots recognized that right-of-way doesn't win an argument in the air any more than it does on the ground—especially when there is no overall standard for determining right-of-way.

Another 10 per cent of mid-air collisions indicates a wrong conception of the purpose of practice areas. Many instructors as well as students regard their assignment to practice areas and altitude levels as a guarantee of security. Actually, the purpose of such assignments is to curtail interruptions by distributing traffic evenly.

The greatest toll of mid-air crackups is claimed by low-sequence maneuvers. Such maneuvers tend to divide a pilot's attention between ground reference points and the instrument panel for relatively long periods of time. "I didn't see him until it was too late," is the common lament after a low-sequence maneuver collision, one of which took place recently in a practice area adequate for five planes.

The chance for survival in any mid-air collision is slightly more than 50 per cent. Study of records for the year 1943 shows that 31 of the 89 pilots and passengers involved lost their lives. Nine were seriously hurt, 47 were uninjured. The airplanes didn't fare so well percentagewise—28 were completely demolished, 28 badly damaged. Only six of the aircraft figuring in such accidents escaped damage.

None of these figures is especially startling when compared, for instance, with collision statistics for automobiles. Nevertheless, in the future the skies will be far more congested with personal planes than ever before. Whether this post-war expansion of aviation brings a corresponding scourge of mid-air collisions—accidents that will take an unnecessary toll of life and that will hurt aviation in general—depends largely on the pilot's own willingness to discipline himself. He must be taught the fallacy of "freedom of the skies"—that flying the airways of tomorrow will require the same patience, concentration and skill required in negotiating our traffic-choked highways. END

Was Air Power a Success?

(*Continued from page 23*)

smaller plants could be seen during a casual drive up and down the river. The big Ford plant near Cologne escaped heavy damage. A 30-acre factory near Grevenbroich specialized in aluminum alloy parts for plane engines. It had never been bombed, and operated until our troops arrived.

The Allied bombing campaigns against German ball bearing factories are already well known. So are the fateful five days of February, 1944, when the Allied Air Forces struck the fighter plane factories at Brunswick, Oschersleben, Bernberg, Leipzig, Regensburg, Augsburg, Furth and Stuttgart with heavy blows from which the *Luftwaffe* never recovered. Certainly the strategic air blows were decisive against the German fighter plane industry and assured Allied control of the air during the invasion and subsequent critical ground actions. In this respect, and at least within this limited objective, General Fuller is wrong in criticising air power's destruction of enemy industry.

He is also wrong in saying that we scattered the enemy's industries. But his error is only a detail. Instead of scattering, Germany's industries went underground. If the war had lasted long enough, enough of them would have gone underground to have made our strategic bombing futile, and perhaps impossible.

Raymond Daniell of the New York *Times* reports "it becomes apparent that one thing was wrong with the calculation of Air Chief Marshal Sir Arthur T. Harris and others, who believed that Germany could be knocked out of the war by air attacks on 60 key cities. They underestimated German industry's ability to go underground." The same could be said of our own air strategists who knew it couldn't be done.

In an afternoon's drive, Daniell counted 23 large slave labor camps holding 1,000 or more. At Igling, a tiny farming community near Landsberg, was a fabulous industrial city in a forest of tall cedars. Invisible from the air or from the road were 150 large factory buildings with flat roofs from which sprouted grass and trees planted in 1½ feet of topsoil. Aerial photographs after the plant was discovered gave no hint of what was beneath, although a network of 15 to 20 miles of concrete roads and railroad spurs showed up mysteriously here and there in the forest.

Alongside this hidden center the Germans had just been completing a huge underground factory for the manufacture of jet-propelled planes. It was a semicircular reinforced concrete structure perhaps a half-mile long and wide enough for a double-tracked railway to run down the center. The factory machinery was at either side. The structure was more than 105 feet high and the engineers obviously had intended to cover it with earth and foliage to resemble a small hill.

Work on this enormous layout began in 1939, was suspended in 1942, and resumed in 1944 when slave laborers began to pour in from the occupied countries. It was just coming into production when captured.

Last December, a Germany broadcast in Hungarian reported a recent visit to an underground factory. "Somewhere in Germany," the reporter entered a fast elevator inside a shed lined with iron plates. He descended for almost a min-

(*Continued on page 106*)

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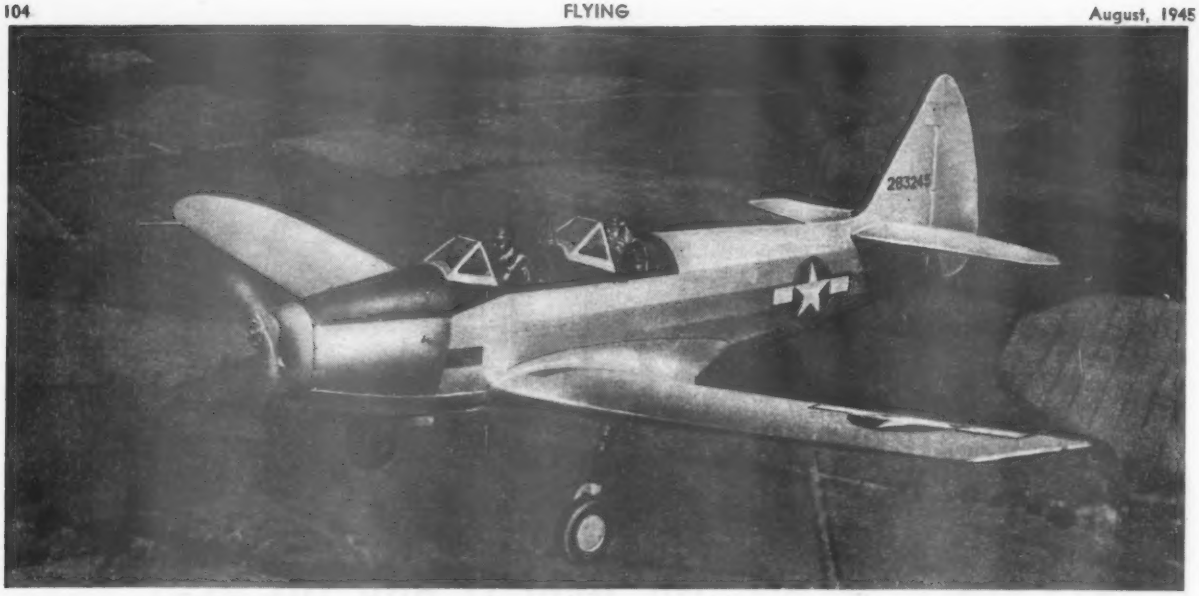

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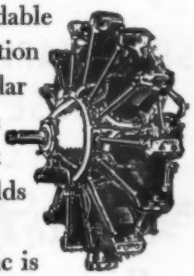
SUCH records of Jacobs stamina and dependability are especially remarkable when it is remembered that in training planes, these engines are handled by the student pilots . . . make more takeoffs and landings, spend more time at full power than plane engines in any other type of military aircraft. And four years of flight training proved that the period of service between major overhauls, originally set at 350 hours, could be satisfactorily and safely extended to as much as 1,200 hours —for the Jacobs! Such dependable performance, low cost operation and maintenance, is of particular significance to private pilots and airline operators who must fly routes with few landing fields and limited service facilities.



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(*Continued from page* 102)

ute and at the bottom of the shaft entered a narrow-gauge railway which took him to the office of the works manager after a journey of about five minutes. The factory was built in an ore mine, and "the hall had a glass roof through which artificial sunlight was shining." While this description does not conform with pictures of another underground plant published in a German weekly magazine, a number of Allied accounts point to the vastness of German underground operations.

Pravda Correspondent Boris Polevoy visited two huge underground arsenals, presumably in Silesia. He descended a deep shaft and walked through endless corridors stacked with bombs, shells and land mines. In another underground arsenal he found an aircraft factory, including a test flying field, power stations, water works and steam heat. The arsenal installations were set in what showed on the map as a virgin pine forest. The Russians found other underground factories beneath the forts of Poznan in western Poland.

Near Vienna, the Soviets captured another huge underground factory—this one designed to make rocket bombs. Beneath Berlin they discovered extensive living accommodations for key families. Goebbels' family had moved to a home 70 feet underground. In the village of Zossen, just south of Berlin, the Russians located the "real headquarters" of the German General Staff, with elaborate telegraph apparatus and living accommodations in a fortress far underground.

At Egeln, Germany, Pfc. James Prenger, Jefferson, Mo., and W/O Joseph Crocker, Cleveland, O., came upon a mine shaft and descended 950 feet in a small elevator. There they found a huge Heinkel-operated aircraft factory winding for miles through underground corridors. This factory was scheduled to produce 700 jet fighters a month within a few months. The corridors were paved with concrete. There were motor-driven carts for key employees and inspectors. The plant was excellently stocked with tools and machinery.

The Germans considered their underground jet plane and robot bomb factories invulnerable. The Nazi manager of the Heinkel factory told Prenger and Crocker: "If Germany had won enough time—about a year—these jets could decisively have changed the air war. All the Allied planes couldn't have bombed us out."

This view is supported by the British disclosures on V-3. *Vergeltungswaffe-drei* consisted of batteries of long-range guns capable of hurling rocket shells 100 miles to rain down on London at the rate of 600 per hour. At Mimoyeeques, near Calais, 50 smooth-bore guns, each 400 feet long and sunk 350 feet into the hills at an angle of 55° were found. The guns had been arranged in two batteries of 25 each trained on London 95 miles away.

The whole installation was protected with 18-foot concrete armor which, if completed, would have been invulnerable to any bomb known, according to the British. This was only one of several large scale sites, though it is known that Allied air activity hampered construction of the rest.

With the evidence we now have, it seems likely that our strategic air concepts would have failed if the Germans had had sufficient time to dig in.

General Fuller also charges that our air strategy did not force the enemy's civil population to revolt. Few air strategists, however, believed that it would—especially after watching the British backs stiffen following the Battle of Britain.

General Fuller also implies that our airpower only stimulated the German civil population to fight harder. This is quite possible, yet sufficient evidence is lacking to us to be certain of it, especially in regard to those German civilians who endured far heavier and more protracted bombings than the British were called upon to bear. Probably the facts are already known to Army intelligence.

The British general contends that we should have bombed the sources of industrial power—the coal fields and synthetic oil plants. In view of the known difficulty of bombing underground installations it is hard to see how our bombs could much have affected Germany's deep coal mines, and her open pit mines were little more subject to bombing damage than gravel pits. Some detailed statistical information on petroleum refinery and synthetic oil plant bombing has been made available, however, to make it plain that these were major objectives of the Allied strategic bombing plan.

The Allies set up a detailed and comprehensive program to destroy Germany's sources of gasoline. It had been projected originally to take six months, but German reconstruction was a prodigy of effort. Altogether, the Allies made a total of 450 attacks on 81 major oil targets—23 synthetic plants and 58 natural oil refineries. The continuous reconstruction effort faltered only when the Germans began to run out of tools and equipment to rebuild these plants.

A captured telegram from Dr. Albert Speer, German production minister, to Martin Bormann, Hitler's deputy, stated that the successful prosecution of the war depended upon the reconstruction of synthetic oil plants and natural oil refineries. The Germans gave this job priority even over submarine and aircraft construction.

General Arnold's report to the Secretary of War for 1944 states that "We know that because of the 8th Air Force's six great bombing operations from May 12 to September 12, the bombing and loss of Ploesti, and RAF attacks on oil plants in Germany, the production of German oil was reduced 75 per cent for September."

On February 15, 1945, every one of Germany's crude oil refineries was at that moment inoperative and only four of her synthetic oil plants were in production. By April 18, 1945, the Reich's gasoline production was only four per cent of normal.

Yet how much of all this was accomplished by airpower? In September, the Russians were in possession of Ploesti

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On February 15, Germany retained possession of only 45 of her 81 major refineries and oil plants. On April 18, she still possessed only five per cent of her crude oil and 25 per cent of her synthetic refineries. This emphasizes again the great need for the most detailed statistical evidence to evaluate the claims of airpower. But at any rate the evidence pretty well refutes General Fuller's charges.

Lastly, the British analyst contends that if we had bombed the sources of industrial power, we should have had more success with forcing the enemy's industries to close.

Here again, unfortunately, Allied Air Intelligence, the source of all our statistical information, does not differentiate between production lost through capture by Allied troops and damage done by the air forces. On April 18, the Army Air Forces released data to indicate that German iron ore output had been reduced 85 per cent, steel-producing capacity 92 per cent, hard coal 99 per cent, lignite 90 per cent and coke almost 100 per cent. But on this date Allied ground troops were occupying most of Germany's important industrial areas. How much was lost by occupation and how much by air destruction?

We must fall back on the non-statistical and unscientific device of citing eyewitness accounts. Two examples can be indicative only.

Prof. Eduard Houdremont, who ran the Krupp Works in Essen, describes the damage of a single bomb, dropped October 23, 1944, which cut the main water supply pipe from the river. The steel production line dropped within a matter of minutes from 42,000 tons daily to nothing. Production started again after several weeks but never thereafter rose beyond 3,000 tons daily.

Officials of the great Siemens-Schuckert works in Nuremberg reported that a bomb in March, 1943, ignited the oil tanks in their transformer factory—the largest in the world—and completely stopped production of large transformers for chemical and steel plants. Siemens-Schuckert was the sole manufacturer of such transformers and never was able to produce them again. Production of motors, dynamos and engines was able to resume after about six months, however, and continued until the latter days of the war when the plant was occupied by Allied troops.

When German Field Marshal Von Rundstedt was captured by the U. S. 7th Army he was quoted by the Associated Press as stating that air power was the most decisive factor in the Reich's military failure.

Reichsmarshal Hermann Goering, founder of the *Luftwaffe*, likewise declared that "the American air force made the Allied offensive possible." His biggest surprise of the war, he said, was the American long-range fighter which made it possible to escort the heavy bombers on strategic missions.

Undoubtedly the defeated German generals are hunting for a scapegoat to blame for their own failures. But the evidence heretofore presented suggests that they are mainly right. When a completely informed and statistical appraisal of strate-

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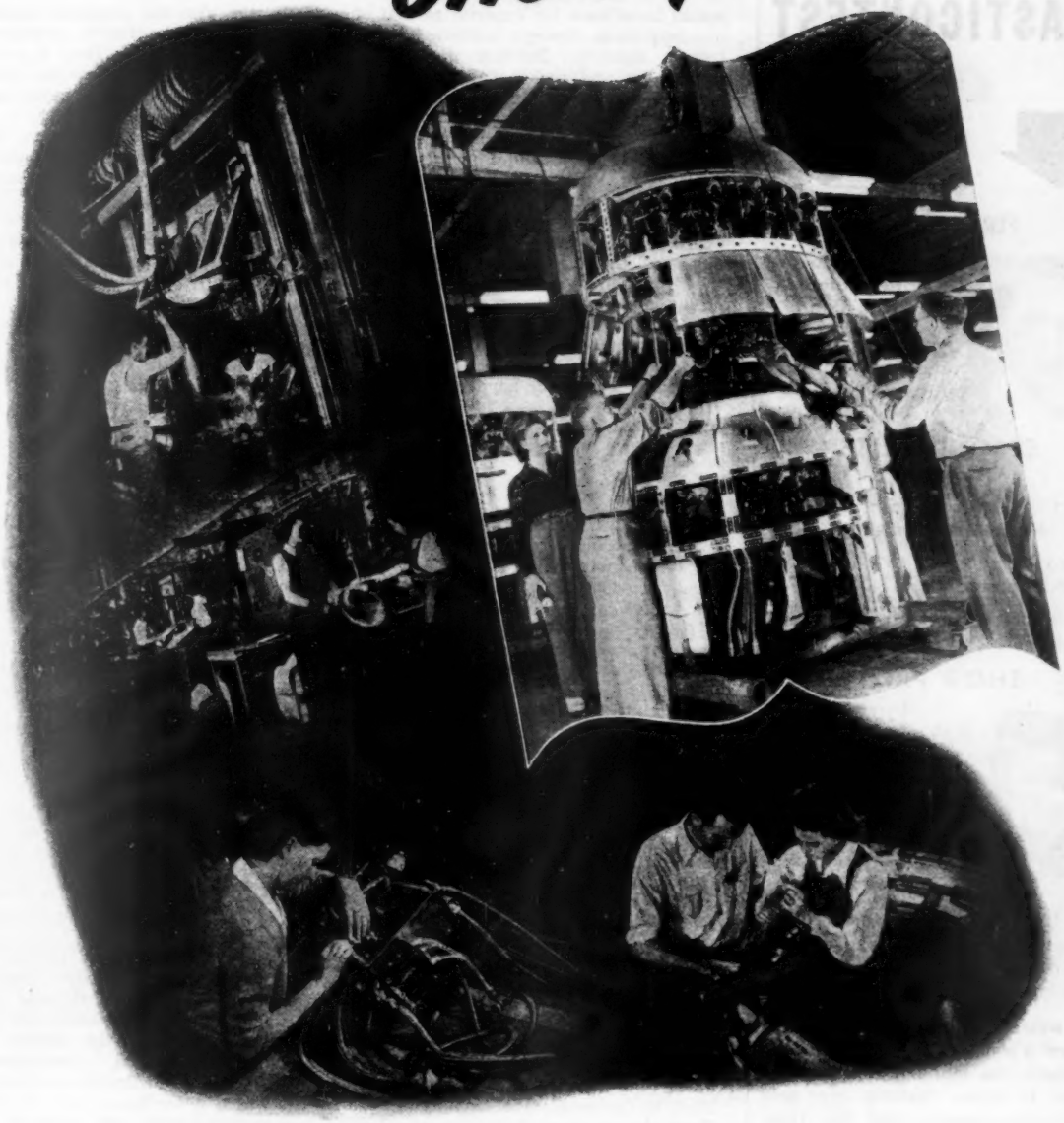

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CLINTON --- MASS.

gic bombing results is made, this writer believes that Allied strategic bombing will be called the decisive factor in bringing about the defeat of Germany in 1945.

If so, however, it will be true only for the time and place. All evidence suggests that if the invasion had been delayed another year, the Germans would have established their underground jet and rocket fighter factories. The speed of these short-range defending craft would have been far superior to that of our long-range strategic bombers and escorting fighters. Because the underground jet and rocket fighter factories would have been invulnerable to strategic bombing attacks, the Germans could have built their defensive strength up to the point where they could have regained control of the air over the Reich. They could have rebuilt both communications and factories under the protecting screen of these fighters and again become a serious aerial threat to the Allies. Certainly they would have had time to undertake aerial counter measures against Britain by means, at least, of the three V-weapons. They might, eventually, have been defeated by ground offensives but if so, air power would not have been the decisive factor.

Over Germany, therefore, aided by fortuitous timing, strategic bombing was decisive. It should also prove decisive against Japan. But the defenses against it have already appeared.

Just how significant these defenses may be if there are future wars is indicated in an interview by John MacCormac of the New York *Times* with top officials of Siemens-Schuckert whose transformer factory was so disastrously bombed. Siemens was also the company operating one of the underground factories described in this article. Here is a classic quotation which symbolizes the German mind and could have ominous significance for the future:

"There can't be another war. But if there were [said the Siemens officials], nothing would serve but to put our factories underground. We could do it even with such heavy equipment as we need. Dispersal, we found, is no guarantee. Put our factories underground and they can't be touched. With our aircraft factories underground, we could maintain a *Luftwaffe* that could protect our transport. Some such factories were begun, but it was too late. But don't talk of another war. Siemens wants to return to peacetime production." END

The Lightplane Dilemma

(*Continued from page* 25)

are working on unusual design features which may constitute a real advancement for aviation but on which they may lose money in the immediate future to the real profit of others in later years. Many of these companies may have no *salable* product to offer the market immediately after the war during the time buyer preferences and dealer organizations are being established.

With respect to successful design timing, a reasonable guess would be that some 20 out of the 30 or so companies with sound aerodynamic designs might prove to have models which will be salable in appreciable volume for several years after the war. This does not mean that 20 companies actually will be able to attain volume sales but only that their products may have sufficient inherent merit to permit effective sales efforts.

Unless all aviation history is to be reversed, radical design innovations will continue to consume considerable time in flight experimentation, elimination of "bugs," production problems, and service testing. In the personal plane field, two other time-consuming factors are added. First is the problem of complying with Civil Aeronautics Authority standards and attaining certificate approval. Second, and even more time-consuming, is the need of overcoming sales resistance—of convincing dealers, and thereafter the consumers, that the innovations are sound, safe, and practical. During the first few post-war years, these factors will seriously hinder the building of markets for many of the radically improved designs.

Once consumer preferences and dealer organizations have become firmly established, the manufacturer who is a late comer with his new design may experience a very costly, heartbreaking task in attaining sales outlets. The "better mouse trap" adage has been disproved too many times. Before the new entrant, by this time ready to produce and sell his radically improved design, can obtain an adequate distribution system, the producers with strongly established marketing organizations probably will have copied his new features at least sufficiently to make his breaking into the market difficult and costly.

Profitable design policies, therefore, must reflect two considerations:

1. The manufacturer at all times must have a product which genuinely appeals to the consumer as improved and progressive. In order to maintain such leadership, it is important that work be initiated in advance on "tomorrow's" airplane.

2. The company which has only "tomorrow's" airplane in experimental development at the end of the war will fail in the even more vital immediate task of establishing itself in the market during the formative period. Consequently, a model which is distinctive and improved but which nevertheless adheres to conventional, proved, and accepted design features must be ready for immediate sale.

To many aspiring designers this may seem a sordid "commercialized" approach. It is, nevertheless, the approach that may best afford those sales, profits and dealers upon the basis of which tomorrow's dream airplane can be successfully introduced—supplying in the meantime the maximum possible employment and consumer satisfaction.

A number of thorough and intelligent studies have been made to determine desirable performance, power, and cost

He's ridden that bulldozer 100 hours this week. He's been bombed 18 times. He's had just three hot meals. And he's still riding that bulldozer. He and his outfit have turned a jungle into an airfield in just 7 days—and hacked a road through from the beachhead.

These are the guys who built our airfields in China, in Alaska, in Guadalcanal, in Saipan, and on Leyte. On their shoulders our air forces have moved up and up and up until now they are hitting hard at the very heart of Japan. These men of the Combat Engineers and Construction Battalions are every inch as much rugged pioneers as any man in our history books. In them today lies high promise for America's tomorrow.

Yes... this flinging of airpower round the globe has called for *human* pioneering on a scale never seen before. And for industrial pioneering to match it... in materials, in fuels and lubricants able to withstand undreamt of extremes of temperature, altitude and speed.

Riding high, wide....and Hopeful!

PIONEERING IN AVIATION FUELS *and lubricants has been the record of Esso Aviation Products. We* pioneered *over 40 years ago when we fueled the Wright brothers' first flight at Kitty Hawk. And we're still pioneering today... with 1,500 research chemists, the industry's largest laboratories, our own giant test blocks. For the U.S. Army and Navy Air Forces we have pioneered over 129 new aviation lubricants and fuels that allow our planes to function either in scorching Pacific heat, or in the freezing air of the stratosphere. Every continuing research coupled with 40 years practical aviation experience puts proof behind the promise that "You can* depend *on Esso Aviation Products."*

YOU CAN DEPEND ON

characteristics for post-war personal planes. The result is a surprising variety of conclusions. In a way, all the answers may be correct. Each of the different models so conceived probably will cater to a considerable segment of the market. But—and it is unfortunate from the standpoint of volume production—no one model appears capable of capturing a major share of the market.

The variations in wing-loading and power-loading that will be demanded by different types of users make it impossible for a single compromise model to meet all objectives. At one extreme of the market will be the ex-military pilots, who presumably will demand the faster flight characteristics of high wing-loadings; at the other extreme will be the amateur-pilot-businessmen, who will insist on the gentler landing characteristics of the light wing-loading. In between will be the performance-conscious sportsman pilots and those younger flyers who pride themselves on piloting skill. As in the past, the variation among individual pocketbooks will create demands for an appreciable range in power-loading as well as in over-all size of the airplane.

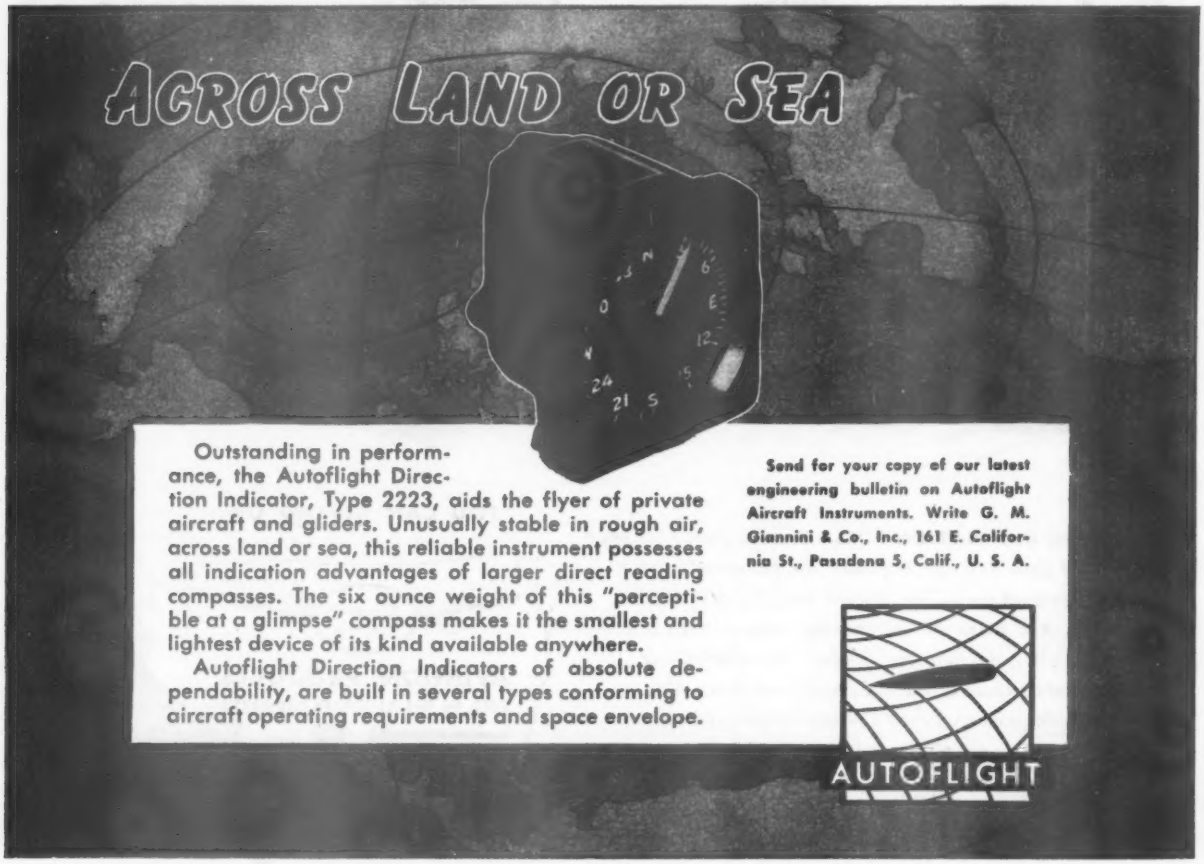
It appears probable that the nature of this market will change decidedly over a period of years as a utility-conscious flying public develops. It will be a happy day for the manufacturer when the tastes of the skilled pilot and sportsman flyer cease to be so predominant a market factor. Although the sportsman market may still be important in total, the consensus seems to be that after a few years the volume of every-day "utility" flying may expand to such proportions that it will dwarf the other uses. The fact remains, however, that immediately after the war private aircraft scarcely will be sold on the basis of practical low-cost transportation for any large segment of the public.

Because of the importance of providing a dealer organization with a product that can compete and make money from the outset, the designer cannot afford to ignore the existence of present-day consumer preferences, even though they often seem based more on psychological considerations than on a logical appraisal of utility and safety. The type of airplane which may be ideal for volume sales to a more utility-conscious market five years after the war may prove to have an inadequate sales potential for the first few years. Unfortunately, however, it may prove too costly for the manufacturer of such an airplane to delay his entrance into the field until after the market has matured. In the immediate post-war years it may be desirable, therefore, to design an interim product to fit the present characteristics of this market even though such an airplane might not be the best possible type for ultimate volume sales.

Whether a manufacturer should, during this developmental period, confine his efforts to one carefully selected model or should attempt to offer a complete "line" is an important question. Production advantages as well as economy of sales effort often suggest one model. Viewed from the standpoint of creating the strongest possible dealer organization, however, a more complete line would appear to be called for. Actually, the best-balanced decision for any individual company may lie anywhere within a wide range of alternatives. The size of different companies' engineering staffs, their capital resources, their preferences concerning types of market, and general company policies will dictate logical differences in objectives.

Although there is no such thing as unanimity among manufacturers, a summary of opinions suggests that, for some, a two-plane line may offer a desirable compromise: typically, one simple, easy-to-fly model in the $900 to $1,500 price range as a trainer and for the essentially economy-minded private owner; and one faster, deluxe, cross-country model in the $1,800 to $3,000 price range, possibly a trim, low-wing design with retractable landing gear. At least at the outset both would probably be two-passenger models with engines ranging from 65 to 125 h.p. and cruising speeds ranging from under 100 to approximately 150 m.p.h. Other types ranging from low-price, single-place, sport planes to comparatively large and expensive amphibians may, of course, appear on the market to serve more specialized purposes.

Many manufacturers freely admit that they have "in the back room" a four-passenger prototype which eventually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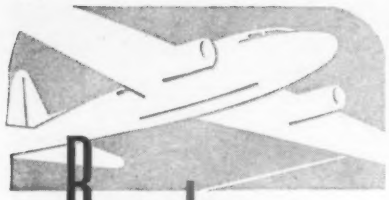

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If you use, or plan to use, air travel at all, you should obtain full details about Connecticut General's broadened protection. Any representative will be glad to give you information.

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they hope to be able to produce at a low enough price to permit volume sales. In the meantime the universal desire for greater carrying capacity may also produce a few three-passenger models. Despite the obvious advantages of the larger aircraft, however, only a small segment of the flying public appears willing to pay the present-day high cost for greater than two-place capacity.

There is one interesting segment of the market, though, which from the outset may be expected to pay the high cost of an airplane capable of carrying four or more passengers at 150 m.p.h. or better, equipped for instrument flight through bad weather. The price of such equipment may remain well above the $5,000 level for some time but the users, being chiefly wealthy individuals and corporations, can pay this amount. Business uses probably will be largely for executive travel and sales work, but also will include special activities such as pipeline patrol. Professional pilots will usually do the flying and the selection of equipment will be based on a careful appraisal of performance characteristics. The sales problems will be more like those associated with selling industrial equipment than those encountered in selling to the public. Direct selling by factory representatives may prove feasible, thus in large part circumventing the peculiar distribution difficulties of the manufacturer who seeks to sell personal airplanes to the flying public.

Mr. Bollinger's article on lightplane marketing problems will be concluded in the September issue of FLYING.—ED.

Buying That Used Airplane

(*Continued from page* 57)

been made as above, the new owner may fly the aircraft on the transferred certificate until such time as the new form arrives from the Certificate Section, CAA, made out in the new owner's name.

If the aircraft has been recently purchased by its present owner, who is now reselling to you, you may find that sufficient time has not elapsed to allow for a return of his new registration to him. In this case, have the registration certificate which was signed over to him, signed over again by him, to you. Then make application as before. However, be certain that the person from whom you are purchasing made proper application for registration. Any General Inspection CAA inspector will be glad to assist you.

It will be noted on the face of Form 308 (Airworthiness Certificate) that it is made out for a period of 12 months. However, under existing war emergency regulations, if the certificate was in force as of January 1, 1942, it is still valid unless it has been suspended by a CAA inspector. In such case, the inspector's signature will appear in the lower left-hand corner in the proper space. If the certificate appears to have expired before January 1, 1942, according to the date indicated in the right-hand corner of the certificate under the inspector's signature, turn the form over and if there is a later date, under approval on the reverse side, that is the date which is pertinent. Upon transfer of ownership, an Airworthiness Certificate remains with the aircraft.

Form 309 is the aircraft operation record. It is part of the Airworthiness Certificate and should be retained in the aircraft at all times. This five-page form will acquaint you with such items as equipment, allowable baggage, gas capacity, history of repairs, etc. Check each item carefully. Page 1 under "Operations Authorized" will reveal any restrictions which have been placed on the aircraft, such as "intentional spinning prohibited." Page 2 under "Engine Manufacturer" and "Propeller Manufacturer" should also be checked to see that these items are the proper installations. For engine model, see the engine nameplate; for the propeller model, see the face or outer surface of the blade. Page 3 is the "Equipment List." See that each item shown thereon is on the aircraft.

If some item has been removed and is shown on page 3, it will necessitate a weight and balance computation by a certificated mechanic which will have to be approved by a CAA inspector to comply with existing regulations. This is also true if some item of equipment has been added to the aircraft and has not been listed on the equipment list. This is necessary to insure that the balance of the aircraft has not been affected adversely by the removal of the item. Page 4 reveals such useful information as the empty weight, useful load, gross load and empty center of gravity. The empty center of gravity is particularly important as it is a reference point from which the mechanic must work, to prove that the balance of the aircraft has not been adversely affected by any addition or removal of equipment. If the empty center of gravity is not shown in the proper space, it may be necessary to weigh the aircraft if any equipment changes have been made, or are accomplished at some future date. The notes listed at the bottom of page 4 will be discussed fully under Airworthiness Directives. Page 5 gives an accurate picture of any accidents the aircraft has been involved in, and ensuing repairs. Be sure that all pages are included in the Form 309.

In compliance with existing Civil Air Regulations, an aircraft must receive a periodic inspection at least once every 100 hours of flight by a properly certificated aircraft and engine mechanic. The result of this inspection is entered in the log books and a Periodic Inspection Report (Form 319) accomplished by the mechanic. This form is then carried in the aircraft file with other pertinent forms until replaced by a more recent one. Read this form carefully, noting all remarks of the mechanic. Has he noted anything that might be marginal and perhaps soon would need replacement, fabric, windshield, controls?

A favorite trick of the slippery dealer is "losing the log books" when an aircraft has logged a great many hours, or, when an engine is nearing a major overhaul.

(*Continued on page* 118)

A MODERN INDUSTRIAL MIRACLE

BY WILLIAM B. ZIFF

On the tenth anniversary of the founding of Bell Aircraft Corporation, the publisher of "Flying" tells of the production record at the Bell Bomber Plant, at Marietta, Ga.

"'THREE hundred Superfortresses bomb Japan's mainland.'

"Who would have believed, just after Pearl Harbor, that such punishment could have been meted out in less than three years' time?

"Yet it was only a few days after Japan's sneak attack that Bell Aircraft was notified by the Army Air Forces that the company had been selected to be a major builder of these giant, Boeing-designed B-29's in a plant to be constructed near Atlanta.

"The construction story of this giant aircraft factory, and its production achievements, form one of the industrial miracles of the war. In eight months after taking occupation of the plant, in early 1943, the first two Bell bombers were towed out for the test flights.

"How large is this plant? Well, imagine, if you can, nearly two Empire State Buildings laid end to end inside the main building. Under its roof there would be room for twenty of the world's largest battleships with enough vacant space for sixty-nine submarines and twenty-four PT boats.

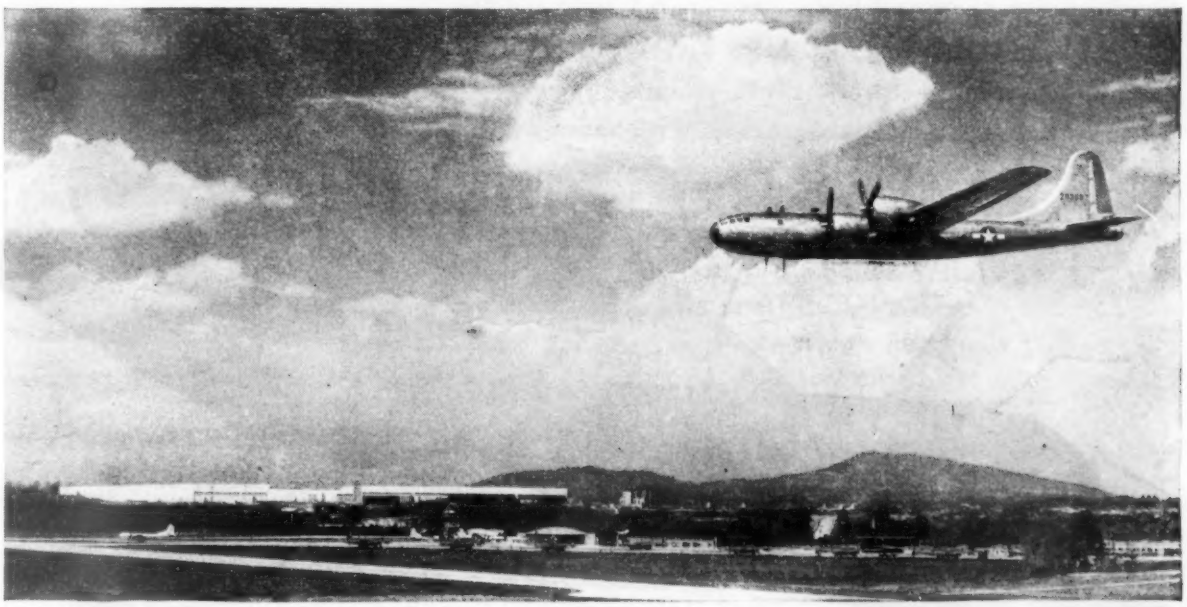
"The B-29 production records being set up by the Bell Bomber Plant are naturally a military secret. But it can be said that production is on schedule and that the schedules have been substantially increased.

"And the mass attacks being made daily by these giant battleships of the skies are conclusive evidence of the teamwork that exists between Bell management and the thousands of Bell employees and the men of the U. S. Army Air Forces.

"The record of the company is clear on the eve of its tenth anniversary. Bell has pioneered in many aircraft developments which have contributed greatly to the war—P-39 'cannon on wings', the first American jet propelled airplane, the P-63 Kingcobra, the Bell helicopter, and the operation and management of this great factory which is the South's industrial miracle of this generation.

"In the coming decade, look to the Bell Aircraft Corporation to continue to be the pacemaker of aviation progress."

★ *Buy War Bonds and Speed Victory* ★



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BELL *Aircraft*

PACEMAKER OF AVIATION PROGRESS

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Buffalo and Niagara Falls, N. Y.
Airacobra (P-39) and Kingcobra (P-63)—Fighters
Airacomet—America's First Jet Propelled Plane
The Bell Helicopter

ORDNANCE DIVISION
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Flexible Gun Mounts and other ordnance materials

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GET THIS FREE BOOK

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(*Continued from page* 114)

If the log books have been lost, be a suspicious buyer until you have reason to believe otherwise. This could cost you the price of a major overhaul on the engine, or the cost of complying with some service bulletins on the aircraft. See if entries have been made in the new log books as to approximate time on aircraft and engine, compliance with service bulletins, etc., the whole to be properly signed by a certificated mechanic and sworn to over a notary's seal. If the dealer or owner presents properly maintained log books, check back in the engine log book to determine how long ago it had a major overhaul, what parts were added, and the service bulletins that have been complied with. On the aircraft log book, check back to see how long ago it had a periodical inspection, overhaul, service bulletins complied with, etc.

In an effort to help the owners of certificated aircraft properly maintain them in safe flying condition, the CAA, from time to time, releases directives in which is contained vital information in regard to the maintenance of aircraft. Some are changes to be made to certain components where a weakness has developed after many hours of flight, others are inspections that must be made at certain intervals. It is mandatory that these airworthiness directives be complied with under Civil Air Regulations. If the aircraft file does not contain a copy of the directives which are pertinent to the aircraft, obtain a copy from a certificated mechanic or a CAA inspector. Also check the log books to see that the directives have all been accomplished and entered in log books signed by a mechanic.

If, after a perusal of the pertinent papers, you are satisfied that everything is in good order, wheel the aircraft into the light. If it's a fabric-covered aircraft, check all fabric carefully. The dope should be resilient and alive. Apply pressure to it with the fingers gently but firmly enough to cause a depression in the fabric covering. If the covering returns to normal within a few minutes it is alive and in good condition. However, if the dope cracks or seems to lack resiliency it is in an advanced stage of deterioration and the underlying fabric must be regarded with suspicion. At the same time, check the covering for tears, cracks and breaks. If the covering has been rejuvenated, it should have been noted in the aircraft log book. In such a case, insist that a small piece be cut out for examination. If, after bending and creasing several times, the surface layer of dope or rejuvenator can be peeled away from the bottom layers of dope, the operation has not been properly performed and the bottom layers of dope have not been rejuvenated. Any rejuvenated covering must be regarded with suspicion as the condition of the underlying fabric cannot be told without exhaustive testing on test equipment.

Inspect the propeller visually for nicks, dents, cracks, proper safetying, and finish. See that it is also free of deep scars, that the varnish is not badly weathered, and that the metal tipping is secure, with no loose rivets. Loose rivets can be detected by inspecting for a break in the solder around the rivet. If the propeller seems in good shape, assume that it is also in track and balanced. If it isn't, it will reveal itself in excessive vibration when the engine is run up.

After carefully chocking the wheels, and with a competent operator at the controls, start the engine. If it is in good condition and the operation properly performed, it should start after the propeller has been pulled through three or four times. After proper warmup, check the maximum r.p.m. If it has a free staccato sound, accelerates quickly, is free from unusual knocks and vibration, and turns nearly the same on both magnetos, shut it down, allow to cool for about 15 minutes and then check each cylinder for compression by turning the propeller through slowly. As it is turned through the compression stroke, each cylinder should require about the same amount of pull. A weak cylinder is indicated when very little effort is required to pull it over top dead center of the compression stroke.

Remove the engine cowl and check for fuel and oil leaks, security of oil and fuel lines, and wiring. Examine the area surrounding oil and gasoline attachment fittings and couplings, for even though the lines have been most carefully wiped off a leak can be detected by the presence of moisture in any exposed threads or in the space between the line and coupling. Gasoline leaves a tell-tale stain from the analine dye present in aviation fuel, so its presence anywhere in the vicinity of fuel lines should lead to a further investigation. Any flexible fuel or oil line should be checked closely. They should withstand approximately a 20-pound pull without separating from the coupling and should be free from checks and cracks. The hose itself should be elastic and should spring back into normal shape after having been kinked or pulled. Check the engine mount for cracks in tubing, particularly around welds. Exhaust collectors, heater muffs and controls also should be gone over carefully. All controls should be operated during this inspection to insure proper functioning.

Inspect all pyralin for security, discoloration, cracks, etc. Inspect interior of cabin for cleanliness, security and condition of floorboards and accessories. Try the flight controls for looseness or slack, also for binding. Control cables should have sufficient slack to allow free movement of the controls but not enough to allow them to rub upon any surface other than the guides and pulleys through which they pass. Look for insecurely mounted or worn pulleys and worn control cables. Be certain that the area under the cabin section is free from accumulation of dirt and oil. Check the inside of the fuselage for dented, cracked, rusted, or distorted tubing. The tubing should have a round, smooth appearance, never deviating in size across the cross section. If the paint or protective coating is crinkled or disturbed at any point, clean the area to the bright metal with an abrasive and examine with a magnifying glass. If a crack is present, it should be seen easily. A slight bulge or a slight

Strong aluminum alloys, available through Alcoa, now cover a wide range of mechanical properties. New design possibilities are being discovered by aircraft engineers as they employ these Alcoa Aluminum Alloys.

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ALCOA ALUMINUM

indentation across the cross section would indicate strain. Any failure as above would necessitate expensive repairs.

With the landing gear raised from the floor, back off all nuts several turns, inspect for worn bushings, elongated bolt holes, distorted or cracked fittings and any looseness in mountings. A bolt should be a snug push fit into a bolt hole with just enough clearance to allow it to enter. The hole should be perfectly round for if it is even slightly oval, the hole is elongated and excessive clearance results. The bolt itself should be free from deep scars, grooves, and should be round and straight.

Inspect the interior of the wings for damage to the ribs, broken rib lacing, looseness in compression members and fittings, cracked or weathered spars, condition of varnished surfaces. If the gasoline tanks are in the wings, special care should be taken in scrutinizing the surrounding area as gasoline or gasoline vapors have a marked deteriorating effect upon varnished wood surfaces and glued joints. Back off nuts on important attachment fittings and check bolt holes for elongation. Check flight struts for bends, kinks, dents, and at point of attachment, for looseness or elongation of bolt holes. Also inspect gas tank for leaks and security of mounting.

Inspect all flight control surfaces, ailerons, elevators, rudder and trim tabs for excessive play at hinges, freedom of control movement and binding. All flight control linkage should be checked at this time for looseness. Hinge pins in all control surfaces should be a snug fit and the holes free from elongation. The hinges should be in perfect alignment to insure freedom of movement and to avoid excessive wear.

The entire aircraft should be checked for distortion by watching for any deviation from a symmetrical pattern. The eye should be able to pick out the damaged rib or the kinked or distorted longeron easily by a comparison with nearby members. Inspect vertical and horizontal fin for security and general condition.

Aluminum alloy is used almost exclusively in the design of some light aircraft. Wing structures are built up using extruded sections in the wing beams, cap strips and stringers of the main ribs, and stampings in the nose ribs. Dural drag trusses are employed using steel tie rods. These tie rods or drag and anti-drag wires are practically the only steel used in the wing structure. The entire assembly is riveted together and fabric covered in the conventional manner. Movable control surfaces are of a similar construction but are metal covered, as are the vertical and horizontal stabilizers.

The fuselage is of aluminum alloy construction, the covering being of formed sheet, riveted, and furnishing a large share of the required strength. The covering or shell is cross-sectional in shape and has light bulkheads placed at intervals to maintain this shape and increase the rigidity of the structure. Flight struts are of low carbon steel. Wheels, brakes and landing gear differ only in design from other light aircraft.

An inspection of the engine, engine controls, flight controls, bushings, bolts, fittings, etc., should be accomplished in the same manner as upon the aircraft of welded tube and wood metal construction. The wings differ only in the materials used and the manner of the attachment of the fittings. As has been mentioned previously, the structure is riveted throughout, so points to check are the points of attachment. Rivets should be inspected for security, being especially careful around the point of attachment of the fittings.

In aluminum alloy construction, the results of a severe stress will be readily seen by a distortion, crinkling, dimpling or cracking of the affected area. Elongated rivet holes and loose rivets also may result from too great a strain. The fuselage skin, including the bulkheads, should be examined for loose rivets, distortion, cracks, dents, and loose skin. The metal covering should have a solid feel with very little give to it. All other metal covered surfaces should have the same solid feel and should be free from the afore-mentioned defects. Any accumulation of dirt within the entire structure should be removed and the underlying area inspected for corrosion which may have occurred. This is easily recognizable by a dark discolored and pitted appearance of the affected area.

Any deep scratches from sharp tools or improper cleaning methods are particularly objectionable on the surface of the

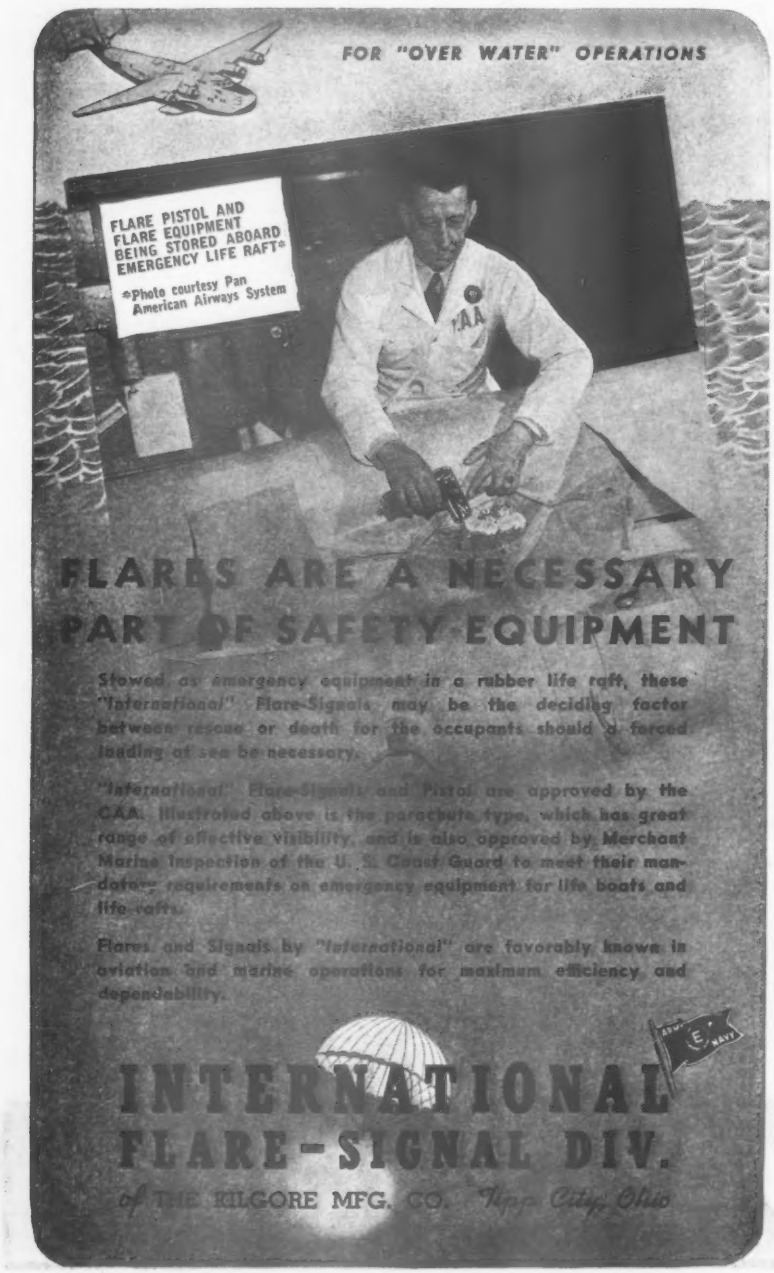
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*Photo courtesy Pan American Airways System
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"International" Flare-Signals and Pistol are approved by the CAA. Illustrated above is the parachute type, which has great range of effective visibility, and is also approved by Merchant Marine Inspection of the U. S. Coast Guard to meet their mandatory requirements on emergency equipment for life boats and life rafts.
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metal skin. Alcad is coated with a thin layer of pure aluminum to protect the underlying alloy from corrosion. If this protective coating is disturbed corrosion may follow, resulting in a failure. A costly repair job might well be the result.

An inspection such as described should take but a few hours of your time and, while it should not be considered a complete inspection (this should be left to a certificated mechanic), it will be well worth the time expended and should reveal any serious discrepancies in the aircraft file. It will be good insurance. END

London Letter

(*Continued from page 47*)

004's giving 2,000 pound thrust.

2. German jet units are highly esteemed, not because of their performance, which is poorer than the Anglo-American jets, but because they were developed and made operational first in spite of the German shortage of nickel.

3. Night fighting equipment included radar similar to Allied. Junkers Ju-88's have upward firing cannon—a night defense scheme originally tried in 1918 but found ineffective until the coming of radar raids.

4. Handley Page wing slots, which delay burbling over the wing at big angles of attack, are used in the Messerschmitt Me-262 and other German aircraft.

5. Most amazing fighter design is a machine found in full production in an underground factory. It is like a flying bomb but carries a man and a couple of cannon in place of the warhead. Engine is a jet unit and mounted in the manner of the V-1, above the fuselage.

6. Another unconventional fighter is the Dornier "sandwich," with pilot between two tandem engines.

RAF Jet

The war in Europe ended before the British jet fighter, the Gloster *Meteor*, could be given a real trial against enemy aircraft. It was used against flying bombs in the summer of 1944 but had only just begun to operate in Germany.

Pilots' opinions about the *Meteor* vary, but the high tail (faintly reminiscent of the *Barracuda*) gives it a clumsy appearance and the jet units seem bulky. High-tailed planes are going to be difficult to avoid with twin-jet machines but the Germans have succeeded in avoiding them.

Already jet work is tending to divide into two streams: axial units and centrifugal units. The original Whittle design is centrifugal but there are special advantages in the axial kind. Very broadly speaking the centrifugal units are likely to be short and fat, the axial long and thin. German jet units have a small, two-stroke gasoline engine for starting.

Civil Air Attache

Peter Masefield is already well known in the United States. When he was writing for the *Sunday Times* and *The Aeroplane* he was often a sharp critic of American aircraft. Later, after his visit to America, he became less acid.

He has many friends on both sides of the Atlantic and his appointment as the first Civil Air Attache in Washington will be widely welcomed. Until this appointment he was technical adviser to Lord Beaverbrook. Tall, stooping, bespectacled, he has a good practical knowledge of broad design problems and is quick with a slide rule. He won approval by going out as observer on bombing raids over Germany with the *Fortresses* of the 8th United States Army Air Force.

Another appointment made as I write, is of W/C Maurice Banks to be Director of Civil Aviation, Trinidad and Tobago. Wing Commander Banks, brother of Sir Donald Banks, former Permanent Secretary to the Air Ministry, has been in aviation since the early days of World War I, has held a "B" (commercial Pilot's) license and knows the problems of civil air transport well.

Manna

The technique of food dropping without parachutes, used by the RAF Bomber Command for relieving starving Holland while the victory flag waving was still going on in Piccadilly, was by no means new.

Soft nose containers had been developed years ago by the RAF. They allowed even the old-fashioned (to us in Britain) shell egg (as opposed to the powdered kind) to be dropped without breaking. *Lancasters* were mainly used, with the food stored in the bomb bay. It was a job which pleased the aircrews more than any they had had during the whole war. One day 600 tons were delivered in this way by *Lancasters*, carrying 6,280 pounds each, which flew in at 500 feet on flare markers put down by pathfinders.

Electrics

All-electric aircraft have made somewhat slow headway over here; pneumatics and hydraulics having a strong hold on most designers. But the new Shetland flying boat is all-electric.

A. Gouge, who had something to do with this new boat, is now with Saunders-Row. He has devised an automatic mooring device for flying boats and believes in very big machines working from special lagoons with covered flying boat docks.

Eyes on the Far East

New appointments give hints of the plans being laid for carrying the war to Japan with all strength. The Admiralty, stating that Rear Adm. Thomas H. Troubridge was to be Fifth Sea Lord (Air), did not reveal what new appointment was to go to Vice-Adm. D. W. Boyd, his predecessor. The Fifth Sea Lord bears the responsibility for the Fleet Air Arm, including its aircraft and equipment.

Fighter Command—winner of the Battle of Britain, which shot down 6,977 enemy aircraft—got a new chief in Air Marshal Sir James Robb. He succeeded Air Marshal Sir Roderic Hill, one of the most promising of the younger officers of high rank in the service today. END

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The Fork-Tailed Devil

(*Continued from page 28*)

plane (used for static testing) got under way. Production workers soon were calling the YP-38 "Yippee," a name derived from the plane's prefix designation, YP. The first YP-38 was flown by Marshall Headle, then Lockheed's chief test pilot, on the morning of September 18, 1940. Engineering on the production P-38 model began late in 1939, with deliveries beginning in July, 1941. The basic difference in the YP-38 and the later model was its use of .30-cal. machine guns rather than .50's.

The P-38D, evolved in 1940 and delivered in 1941, marked the installation of self-sealing fuel tanks and a change from a high- to a low-pressure oxygen system. In the next model the cannon was changed from 37-mm. to 20-mm., which has been standard in all subsequent models except for the unarmed camera planes. This model also saw the replacement of the hollow steel propellers with Curtiss electric constant speed propellers with dural blades.

About this time the Model 322 (or *Lightning I*) which was designed for the British, came along. It had low-powered engines, no superchargers and did not meet performance expectations. This model further suffered from British insistence that the propellers turn in the same direction. This added torque, which had been eliminated in the American model by turning the blades in opposite directions. The contract was ultimately cancelled and the handful of Model 322 planes was converted as nearly as possible to the model used by the AAF to train American pilots. So far as is known, not one of this model has been in combat.

The P-38 was slow to make itself felt in actual warfare. People began to wonder why the Army didn't use it in combat. The Army couldn't reveal that the *Lightning* was to make its debut in the invasion of Africa. There was a trickle of interest in the new plane when Capt. (now Col.) Karl Polifka was reported in Australian dispatches to have flown a P-38 photo plane over a Japanese fleet that was moving toward Australia.

News of P-38 activities blacked-out for about a year. Suddenly the reason for silence was made known—Africa was invaded. The first American planes to strike the enemy from air fields in Morocco and Algiers were P-38's that had been flown down from England. Not until a year after the feat had been accomplished did censorship allow the story of how fleets of P-38's, escorted by *Flying Fortresses* that served as navigational shepherds, had flown across the North Atlantic from America to England—the first fighter craft to make the crossing. Only one of these long-range *Lightnings* was lost at sea.

In the African campaign the P-38E also got its first taste of combat. These long-range fighters, equipped with droppable fuel tanks, struck at the enemy over great distances from fields well behind the lines. They served as tank busters at Kassarine Pass, escorted bombers in scores of raids against Axis-held Europe, bombed and strafed and photographed thousands of square miles of occupied territory and, in general, helped pave the way for invasion.

Development of P-38 camera planes began in 1941. First of its kind, the F-4 (an adaptation of the P-38E with new autosyn-type instruments) was equipped with four cameras. This model also was equipped with drop-tank brackets and was the first to be converted into the famous "piggy-back" plane for fighter pilot training—an advancement that substantially reduced the percentage of Army flight accidents in this phase of training from an index rate of 6.5 to 1.5 within two months.

In the fall of 1942 the F-5, a specially-equipped P-38F camera plane, was unveiled. It carried five cameras, had the Allison V-1710-F5 engine and was the 12th P-38 model to be released. The 13th, which was ready in May, 1943, upped engine horsepower to 1,000 normal, 1,325 war emergency for each engine.

Other modifications of the fighter craft followed rapidly, the most important being those incorporated in the P-38J. The J, first delivered in August, 1943, had more changes than had been made in total since the fifth model appeared. More horsepower was added by using Allison

EVOLUTION OF THE LIGHTNING

Model	Engine Model (1)	H.P. Norm.	H.P. Mil.	Gross Weight (2)	Range in mi. (3)	Top Speed (4)	Armament: Mach. Guns	Armament: Cannon	MODIFICATION
XP-38	V-1710-C9	980	980	11,500	1,300	403	2—.30's 2—.50's	1—23-mm.	
YP-38	V-1710-F2	1,000	1,150	13,500	1,300	403	2—.50's	1—37-mm.	High-pressure oxygen equipment added. Turbosuperchargers moved to top of booms.
P-38	V-1710-F2	1,000	1,150	13,500	1,300	403	4—.50's	1—37-mm.	First regular production model. Same as YP-38.
P-38	V-1710-F2	1,000	1,150	13,500	1,300	403	4—.50's	1—37-mm.	Second production model. Armor plate, bullet-proof glass added.
P-38	V-1710-F2	1,000	1,150	13,500	1,300	403	4—.50's	1—37-mm.	Improved radio in 3rd model. New instruments, improved oxygen equipment.
P-38D	V-1710-F2	1,000	1,150	14,500	1,250	403	4—.50's	1—37-mm.	Self-sealing fuel tanks—new low-pressure oxygen equipment.
322	V-1710-F2	1,000	1,150	14,500	1,250	403	4—.50's	1—37-mm.	British model. No superchargers. Propeller rotation in same direction.
P-38E	V-1710-F2	1,000	1,150	14,425	1,250	403	4—.50's	1—20-mm.	New Autosyn type instruments.
P-38E (LR)	V-1710-F2	1,000	1,150	14,425	2,300	403	4—.50's	1—20-mm.	Long-range bombing model. Wing shackles hold one 150-gal. droppable fuel tank or one 1,000 pound bomb each.
F-4	V-1710-F2	1,000	1,150	14,425	2,300	403	None	None	Adaptation of P-38E. Four cameras.
P-38F	V-1710-F5	1,000	1,325	14,425	2,300	403	4—.50's	1—20-mm.	Resistance type instruments, desert equipment, battery-cart plug for field starts.
F-5	V-1710-F5	1,000	1,325	14,425	2,300	403	None	None	Adaptation of P-38F. Five cameras.
P-38G	V-1710-F10	1,100	1,325	14,425	3,050	403	4—.50's	1—20-mm.	Auto. engine temp. control; demand-type oxygen equip.; heavier wing shackles.
P-38H	V-1710-F15	1,100	1,425	14,425	2,700	403	4—.50's	1—20-mm.	New type turbosuperchargers.
P-38J	V-1710-F15	1,100	1,425	14,425	2,700	403	4—.50's	1—20-mm.	New core intercoolers, engine cowling; flat panel windshield of bulletproof glass.
P-38K	V-1710-F17	1,100	1,425	14,425	2,700	403	4—.50's	1—20-mm.	Propeller gear ratio changed to accommodate new 12 ft. 6 in. propellers.
P-38L	V-1710-F30	1,100	1,425	18,000	over 3,000	over 425	4—.50's	1—20-mm.	Improved superchargers. Propellers changed back to 11 ft. 6 in.

(1) All engines are Allisons.
(2) From model P-38E through P-38L, gross weight varied with duty of plane.
(3) Range is dependent upon gross load, altitude flown and whether equipped with belly- or wing-tanks.
(4) Top speed is given in m.p.h. Figures shown are those permitted by military security and are very conservative.

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V-1710-F15 engines, and rate of climb increased 100 per cent at altitudes over 30,000 feet. Built-in, bulletproof tanks increased range 30 per cent, service ceiling was raised to "well above 40,000 feet," straightaway speed was boosted and single-engine speed increased to more than 300 m.p.h. It was during production of this model that the compressibility dive flap was introduced. Not only were the flaps incorporated into the assembly of the J model, but special kits were rushed overseas so that they could be added to earlier P-38's already in service. It was not until the L model was released that both dive flaps and aileron boosters were made standard equipment.

The P-38K had the Allison V-1710-F17 engine, which put out the same horsepower as its predecessor but had a different gear ratio to turn the new 12 ft. 6 in. propellers. This model had unusually high performance, but the engine manufacturers couldn't make the necessary changes quickly enough to insure quantity production. Hence production models jumped from J to L, with K written off as an experimental model.

All model changes indicated by the suffix letter are dictated by the Army. Basic major changes have been made, however, with no change in model letter. All changes are, nevertheless, recorded by Lockheed in their own identification system. From this one learns that there were actually 50 to 60 versions of the *Lightning*. Master records show that more than 700 changes have been made. One change as an example, was the addition of aileron boosters and dive flaps on the model J after a large number of this model had been built, but it still remained the Army's model J.

The dive flap, which is *not* a diving brake, proved that the buffeting encountered by the *Lightning* in high speed dives was caused by airflow action on the underside of the wing when it entered the compressibility shock wave. Wind tunnel experiments were conducted, and finally W. W. Beman, Lockheed's chief aerodynamics engineer, proposed that a dam under the wing, well forward of the leading edge might control the flow of air in the compressibility field. A trial proved his theory correct and ended compressibility buffeting.

Model P-38L, the newest (and last) "On-To-Tokyo" P-38, is the only one factory-equipped with the hydraulic aileron booster control. The action of the boosters is automatic, enabling the pilot to roll the heavy twin-engined fighter more quickly than most lightweight fighter planes—negotiating a complete 360° wingover in less than three seconds. A fast roll is one secret of combat efficiency in fighter craft and the P-38 can execute the maneuver on one engine. Even though the quoted terminal velocity for the P-38L is 575 m.p.h., and its level flight speeds more than 425 m.p.h., controls are never stiff. If boosters should be shot out by enemy action, control could still be maintained manually.

The P-38L, designed originally as an intercepter, has become more truly a fighter-bomber, carrying a bomb load of 4,000 pounds—greater than that of the early *Flying Fortress*. It has increased its already fast rate of climb to 3,200 f.p.m. at 3,000 r.p.m., using 54 inches of mercury. In spite of its 18,000-pound gross and 21,400-pound overload, the P-38 takes off in 1,030 feet. The P-38L returned to the 11 ft. 6 in. propeller, geared to Allison V-1710-F30 engines.

The *Lightning* was assigned to specific phases of aerial warfare because of its adaptability to certain operations. Its unique design, however, led to its consideration as a carrier-based fighter, a torpedo-bomber and a ski-equipped fighter for far-north operations. At least one P-38 with full-retracting skis was tested but never produced in quantity. Some specially-equipped models were tested as torpedo carriers, using dummy torpedoes. And while no known arrangements were made culminating in carrier tests of this plane, Lockheed engineers say such an adaptation would be feasible.

When converted to glider-towing, the P-38 theoretically became a 15-place transport plane. Tests proved that the P-38 could successfully tow a fully loaded CG-4A glider.

The *Lightning* is more effective for every duty assigned to it today than it was in prototype. This performance record has been established despite the addition of 3,898 pounds empty weight, 6,500 pounds gross weight, 6,190 pounds overload weight and an increase of 13 pounds in wing loading. The *Lightning*—the fork-tailed devil—did not grow obsolete with age—instead, it improved vastly. But progressive demands of aircraft science have pushed the P-38 to a place in history as newer and faster jet-propelled planes demand the attention of today and tomorrow. END

Kick that Ball

(*Continued from page* 43)

its right wing is still low. Now, you may not want to turn, in which case, level your wings. The airplane then will fly straight, the ball centered. But note that this one simple change—different rudder pressure—promptly put the airplane into a normal flight condition. Of course, in actual practical flying you center the ball and level the wings simultaneously. But the way in which you think about it makes a big difference in your flying.

Observe what happens in a turn, say to the left, at 45° of bank. The ball is off center to the right, or on the "high" side. What exactly is wrong? How would you correct it? The rate of turn depends on the angle of bank and the amount of back pressure on the control; the bank is always right for the turn, because it is what causes the turn. Steepening the bank will not return the ball to center. This can be proved if you change rudder pressures and simply steepen the bank without, at the same time, increasing the back pressure so as to hold altitude. You will finally have to give up because the angle of bank, "g"-load and

(*Continued on page* 130)

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★ Home is heaven to men overseas. And a letter is a five-minute furlough at home. So however busy you are, find time to write that man in the service. When you write, remember these 3 rules: 1. Short, frequent letters are better than occasional long ones. 2. Write cheerful newsy letters about familiar places and faces. 3. *Use V-Mail*, because V-Mail gets there quicker, saves space for vital supplies that help speed Victory. Why not read this magazine later and write a V-Mail letter now?

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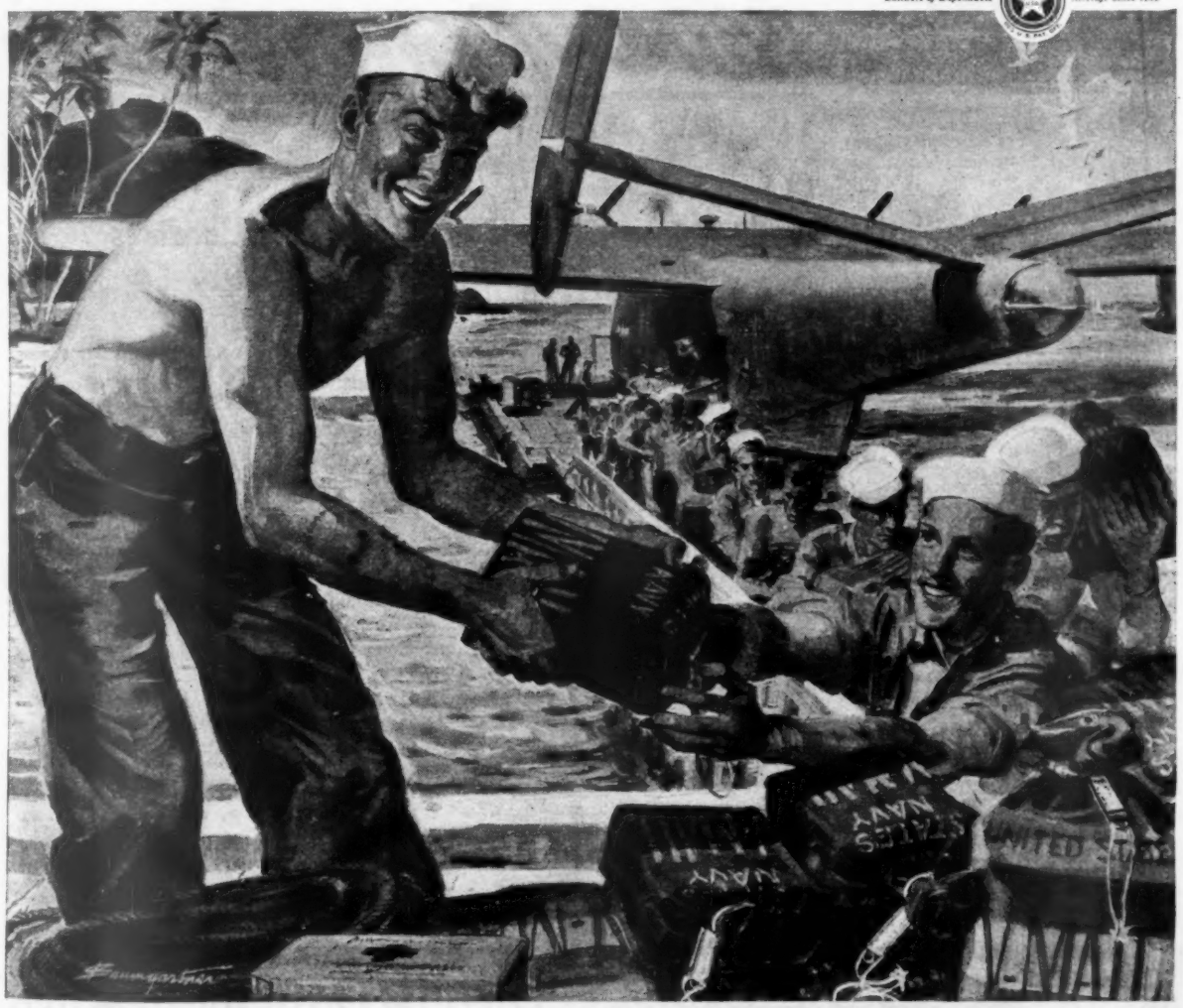

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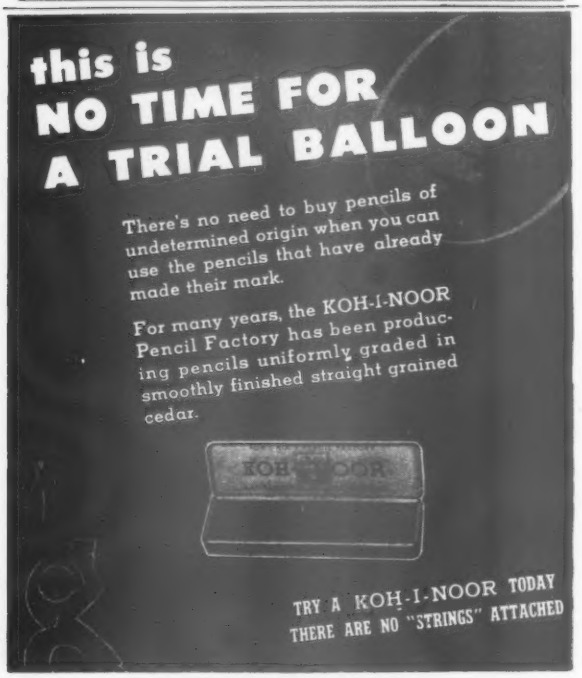
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(*Continued from page 126*)

loss of speed will become excessive—and the ball will *still* be on the high side.

The ball stays on the high side simply because the pilot is holding bottom rudder. He is yawing the airplane to the low side, thus making it slide sidewise through the air toward the high side—a good way to spin out of a power turn, incidentally. The remedy here again is to *kick* that ball! Add a touch of right rudder pressure or release some of the left rudder pressure. The ball will immediately go to the center and stay there.

Whenever the ball is off-center it indicates one thing and one thing only—wrong rudder pressure. The rudder was put on the airplane not to make it turn but to allow you to kill slip or skid, i.e., sidewise slithering through the air or, on occasion, to allow you to cause skid or slip deliberately. Its main purpose is to counteract various effects which might cause such sidewise slipping flight, primarily engine torque and aileron yaw. Sidewise-slipping flight indicates that you are *not* using rudder when you should, or that you are using rudder when you should not. In any case, the remedy for an off-center ball is rudder pressure—more rudder on the side toward which the ball has rolled.

A smooth pilot never actually will kick his rudder. But it is his foot, not his hand, which should react to the ball. As a simple rule, it may help to think that your foot is kicking the ball *away*.

When you fly entirely by "feel" you use the rudder to maintain lateral balance. When the airplane's altitude feels wrong to the "seat of your pants," you don't change bank, you simply work the rudder until the airplane's seat is squarely and firmly under you. This is why a ball on the instrument board *can* be actually detrimental, and why many instructors don't like one before their students. If you think of the ball as a "bank" or "wing-low" indicator, then in a skid, your "feel" tells you to do one thing, use the rudder, while your instrument tells you to do another thing—use the ailerons. This could result in confusion and rough flying habits. If you accept the ball as and indicator of slips or skids, which call for corrective rudder action, then a glance at the instrument tells you the same thing your senses should tell you, only more accurately.

At this point someone will ask: "If, in instrument flying, you control the ball by ailerons and the needle by rudder, why not in ordinary flying?"

There are several answers to this. First: instrument flying is a special case because you can't see your bank. We don't *actually* control the ball by aileron and the needle by rudder; we only pretend to. In pretending to kick the needle over, we actually kick the ball to the side; then, in getting the ball centered, we bank the airplane. In stopping the needle by rudder at the desired point, we kick the ball off center; and finally, in centering the ball, we keep the bank from increasing. It is merely a round-about way of flying.

Secondly, the needle-by-rudder way of instrument flying is more appropriate to the older airplanes than the newer ones and to slow ones than to fast ones. Many modern airplanes are flown on instruments by controlling the turn indicator hand with the ailerons, blending in rudder as necessary to keep the ball centered. In short, they are flown by a normal technique.

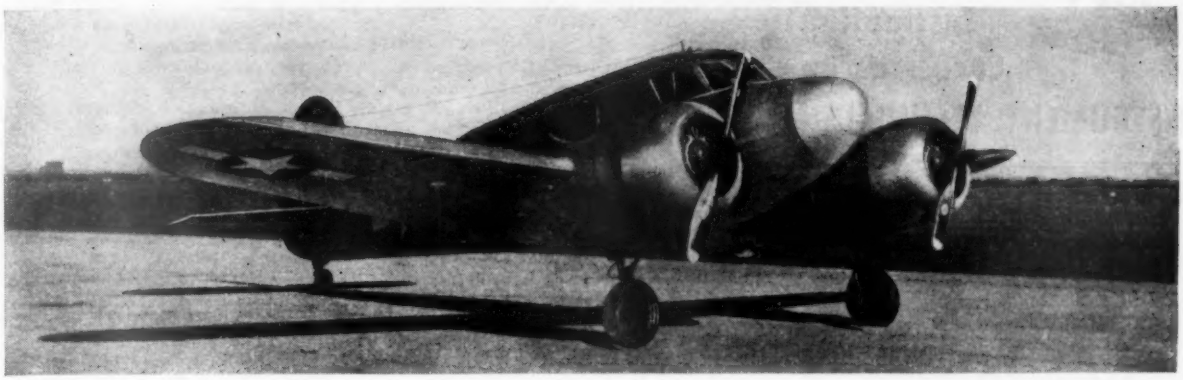
Finally, the present trend in instrument flying is away from all mechanical systems which control specific instruments with certain controls. You visualize the airplane's altitude and flight condition from the combination of all the instruments and then you fly the airplane according to normal technique. Normal flying technique means keeping the ball centered by using the rudder correctly. END

Report from Washington

(*Continued from page 39*)

the private pilot. Free castering wheels equipped with springs to provide a measure of directional control and to dampen shimmy appear to be the ultimate solution.

Consolidated-Vultee has a $1 contract with CAA covering research on lightplane landing gear, including cross-wind mechanisms. The studies are confined to the tricycle types, such as the *Ercoupe* and the *Skyfarer*. One obvious advantage of cross-wind gear is that planes so equipped need only an air strip for take-offs and landings. Its development and practical



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Briefings

By the time this issue of FLYING is out, the Aeronautical Chamber of Commerce of America will have changed its name to the Aircraft Industries Association of America. Major reason for the change is to remove any doubt that the group is an industry representative. Although ACCA has never been affiliated with the U. S. Chamber of Commerce, some quarters believe it is a unit of that organization.

The new line-up of officers of ACCA's Personal Aircraft Council: William T. Piper, Sr., chairman; Carl Friedlander, vice-chairman; Joseph T. Geuting, Jr., manager. Geuting has been acting manager since John E. P. Morgan was named executive director of the entire organization.

Republic Aviation is searching for engineers to work on the XF-12, the projected four-engined transport which may become an AAF photographic plane. The prototype probably will fly late in the summer. . . .

British Information Service has announced the new four-engined Short *Shetland* flying boat prototype has 10,000 h.p. (four 2,500-h.p. Bristol radials), gross weight of 130,000 pounds, wing span of 150 feet and overall length of 110 feet. It cruises at 184 m.p.h., has a maximum speed of 267 m.p.h. . . .

T. P. Wright, Administrator of CAA, delivered the Wilbur Wright memorial lecture before the Royal Aeronautical Society in London, May 31, and made a tour of the Continent to study the effect of Allied air bombardments.

FRANKLIN D. WALKER

Eyes that See

(*Continued from page* 31)

But military minds remained unimpressed. Men were needed who could identify planes, tanks, guns—one's reading rate or his ability to recall digits just didn't seem pertinent. So WEFT remained the accepted identification training system of our armed forces. WEFT is a system which gets its name from its drills on differences in wings, empennage, fuselage, and tail structures of aircraft. Of course, everyone feared—even back in the 30's that WEFT was as outmoded as a 1918 *Spad*. But it took World War II to substantiate those fears. Along with hundreds of similar accounts, war records show that of the 92 planes lost in the Dieppe raid, 60 were shot down by British antiaircraft; that on the first day of the North African invasion, American batteries shot down two British *Spitfires* and a little later three of our own L-5 liaison planes; that Italian planes had destroyed Italian cruisers and fire from Italian guns was responsible for the death of their own air ace, General Balbo. The thing that kept air war from becoming even more of a suicidal affair—where everyone was inclined to shoot first and ask questions later—was the Navy's decision to give the Renshaw system a try.

As early as November of 1941, Dr. Renshaw had added silhouettes of planes, ships, and tanks to the simple geometric shapes, numbers and words he had been using on his tachistoscopic slides. There weren't many accurate pictures of war planes in circulation those days and many of the slides were reproduced from pictures published in just such magazines as FLYING. Despite the handicap of improvised equipment, by the spring of 1942 Dr. Renshaw was able to demonstrate to a commission of the Navy's Bureau of Medicine and Surgery that split-second skill in perception was not confined to the reading of words and digits. He showed how persons with untrained eyes were only 20 per cent accurate in reporting on familiar aircraft shown to them at the comparatively long identification interval of 1/25 of a second. In contrast, he demonstrated the visual proficiency of his own trainees—students who could report with 98 per cent accuracy on plane after plane flashed on the screen at only 1/100 of a second. The astounded Navy commission wanted to know how the miracle had been achieved—whether the methods used could be adapted to mass training.

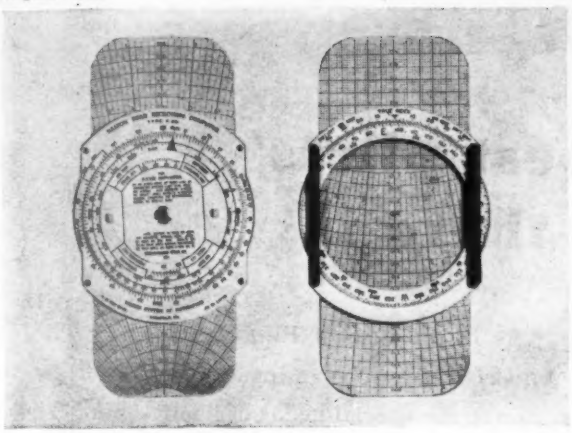
The answer Dr. Renshaw prepared for the first question summarized more than 12 years of experimental research based on his own hypotheses and on those of other scientists—men like Mach, Husserl, von Ehrenfels, Schumann. Among other things, the report pointed out that "things are only *seen* when grasped as unitary wholes."

It seems that very young children have this ability natively. (That perhaps explains why, when the Army recently flew an enemy plane for an hour over airminded Dayton, Ohio, only two Daytonites spotted it—both of them young boys). But from the time we begin to learn the ABC's, most of our visual training is directed toward seeing disjunctively, minutely. Unless trained otherwise, the Renshaw report pointed out, 90 per cent of high school and college age youth see in this disjunctive fashion; they are at least partially form blind. The Renshaw system is simply a form of training that breaks down the disjunctive responses of the eye to visual stimuli and exercises our natively coherent responses of sight.

Convinced of the soundness of the Renshaw methods, the Navy never waited for an answer to its questions concerning how the method could be adapted to mass training. There was a flurry of civilian contracts, a general order or two, and on the 20th of April, 1942, the first detachment of 30 Naval officers arrived at Ohio State from Annapolis. The Navy gave Renshaw only until the 10th of May to make identification experts of them. Their disgruntled commander at Annapolis suggested (in a letter to Renshaw) that even 20 days was an undue waste of time.

Important changes in training procedure had to be made in record time.

(*Continued on page* 136)



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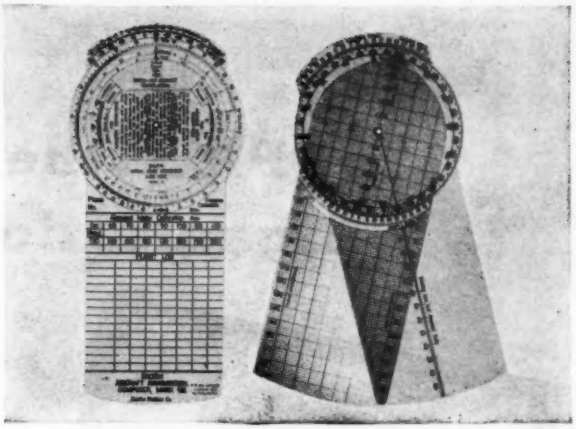

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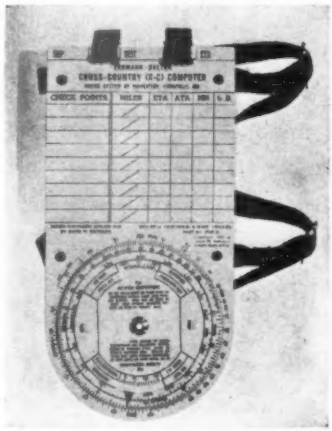

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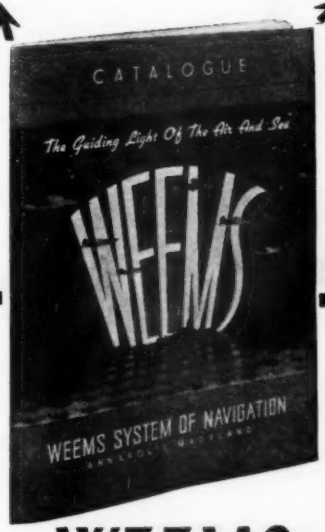

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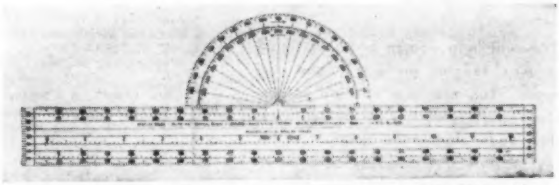

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MOTORCYCLES

(*Continued from page* 132)

Near-point training devices (which flash the image to be identified before a single trainee at a 16-inch, or reading distance) had to be redesigned for far-point training, so that an entire class could be trained at once. And that was only one of many mechanical as well as technical problems that Dr. Renshaw and his two assistants, Sherwood McIntyre and William B. Schimp, had to solve. At the same time they were writing study manuals and plotting teaching procedure. "Actually," Renshaw says, "we were able to keep only about a week ahead of that first group."

But the results of that hectic first month of training more than sold the Navy on the Renshaw system. The Annapolis commander penned his signature to an apologetic letter which expressed amazement at the progress made. He would have been even more amazed at the tremendous strides the instructors had made during those first few weeks toward solving the mass-training problem. Instruction manuals had been prepared which carefully charted each training step from the time a student struggled to retain a part of a six-digit figure shown at 1/25 of a second to the time he could count and identify a skyful of different planes at 1/100 of a second. Renshaw's staff of instructors was being prepared for the influx of trainees which was soon to reach a total flow of over 500 every eight weeks. Plans had been drawn up with the Three Dimension Company of Chicago for the mass production of the thousands of projection kits and the millions of slides that were to go with these trainees to ships and Naval air stations all over the world.

Some of these devices were the product of Renshaw's own mechanical genius—he holds basic patents on at least three tachistoscopic modifications. One such modification is a focal-plane shutter which does away with what photographers know as gamma distortion—where opening and closure of the projection shutter causes the image on the screen to unfold from the center to circumference and back again. The Renshaw shutter gives a full image for the full period of projection. Another Renshaw invention was a new filter that sets a new high in heat resistance. And there were his chromium-plated shutter blades which keep a projector from going bad when exposed to salt spray.

But even more amazing than the ingenious gadgets devised—instruments that now fill almost an entire floor of Ohio State's education building—were the new discoveries made during the training sequences. The significance of some of these discoveries is evidenced best in actual incidents.

There was the British sailor—one of a group of English trainees assigned to study the Renshaw system for possible incorporation into British identification training. This salty tar swore he needed no training to identify any ship that sailed the seven seas. Five British ships were flashed for him at 1/25 of a second and he made a perfect score. It was Renshaw himself who, with a bit of a gleam in his eye, asked the sailor to try again—the same five ships at the same exposure. Cocksure, the tar complied. But this time he saw ships that were upside down, that stood on their stacks, their bows, their sterns. He couldn't tell them apart. They almost had to lead him away after he saw trained observers identify ships and planes shown in any position at only 1/100 of a second.

Once a student has achieved total perception, it appears, he can identify objects whether in or out of their normal context. That has profound significance for the flyer who seldom sees ships, planes, or tanks in their normal attitude. It explains, too, why Renshaw chose the two-inch square slides for a training device. "You can't run a film through a projector sidewise," he observes dryly.

What's even more astounding is the fact that total vision enables the observer to detect instantly changes that have been made on familiar objects. This discovery was made when Renshaw directed his helpers to flash without warning a slide showing an echelon of familiar planes in which one had been "doctored"—its tail surfaces altered or a turret painted out by the staff artist. Trained students would report correctly the count of planes and identify all save the doctored one. Their puzzled concensus concerning it was that "something's wrong." It all boils down to what Renshaw describes as "an insult to the basic-form concept."

Just what the ability to know "something's wrong" means to our airmen is best evidenced by what happened to some Jap pilots (who didn't have the ability) at the Battle of Midway. Mistaking what was then the brand-new Grumman *Avenger* for the similar square-wing *Wildcat*, they flew alongside the *Avengers* squarely into the path of their deadly rear-turret fire. The Nips had experienced no "insult of form," no warning that "something's wrong" with a plane that suddenly develops a hump on its back.

Other experiments substantiated the old advice about never reading in bed. Best vision, it is found, is achieved in an upright position. Lying on one's back lowers visual acuity, lying on one's stomach lowers it even more. Incidentally that may explain why the speed of German jet and rocket-propelled planes worked so little to their advantage. The German planes were faster than ours, but the sight of their pilots (who were forced to fly in a prone position) was considerably slower.

There were a few dissensions and setbacks mixed in with the new discoveries and progress the Renshaw staff made. The Navy, for instance, had been a bit impatient from the very first about the doughty little professor's insistence on digit training. His argument that digits or letters comprise the most familiar symbols—and hence the most useful for early training schedules—failed to impress them. As a matter of fact, when the Navy finally took complete charge of the training program, digit training was dropped—but only for a time. The slump in trainees' achievement curves occurred precisely as Dr. Renshaw had predicted it would. Now digit training is again a

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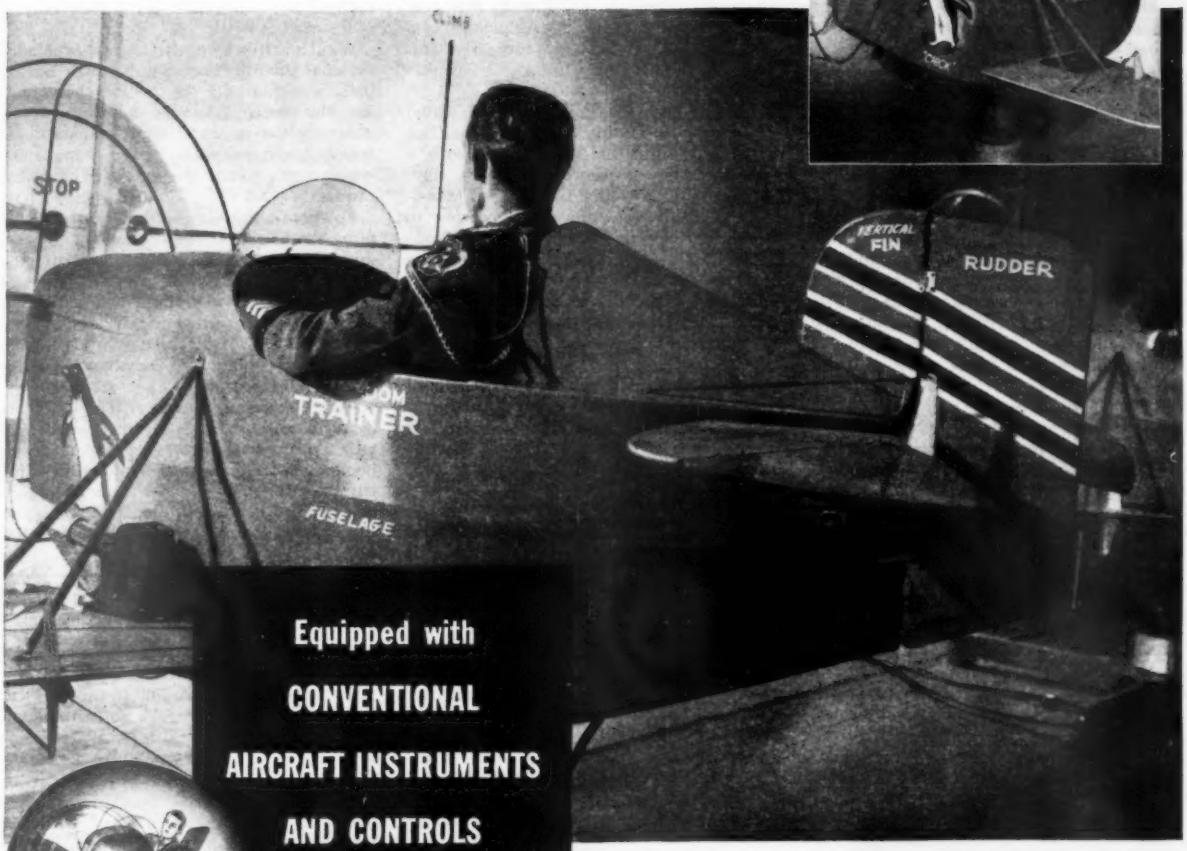

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part of the Navy identification course.

There was also a minor ripple about the "spiral" training sequence set up by Renshaw—a schedule which required repeat performances on the part of trainees at intervals calculated to produce the greatest powers of recall. Navy instructors who followed their own inclination in setting up training schedules, however, found that very much deviation from the Renshaw "spiral" brought another slump in achievement curves.

Then there were minor squabblers—pseudo scientific and educational authorities who argued that one's visual formfield could not really be enlarged as the Renshaw system claimed. It took less than five minutes to convince your author on this score. Seated at a "perimeter," one of the countless Renshaw testing devices, he focused his eye on a target just 16 inches directly in front of him. On a circular track which kept it at this same 16-inch distance, an object was moved steadily toward the point of eye focus. Not until it reached a point just 12° off the line of his vision could he identify the object. But, only a short time before, Col. L. C. Graves, a pilot, had identified objects at as much as 64° from the line of focus.

"Some eyes are unconsciously trained for that sort of performance," Dr. Renshaw pointed out. "Streetcar motormen, for instance, often develop a wide range of vision, But the majority of us must be specially trained." Actually, such training results in the daytime use of the rods as well as the cones of the eye. The rods are visual receptors which make possible night vision—their position to the sides of the eye's perceptual area make night vision an off-center, out-of-the-corners-of-your-eye affair. Normally, rods are not used in day vision because of the adequacy of the cones (receptors near the center of the eye) for normal requirements of vision. In developing this corner-of-the-eye vision, the Renshaw system, therefore, has automatically improved night vision to a measurable degree.

Actually, Dr. Renshaw directed Naval identification for only a few months. But in those months he supervised—with a staff that never numbered more than seven members—the training of thousands of individual officers who were to pass their training on to yet other thousands in Naval air stations and on the ships at sea. He saw the system expanded to meet the needs of the entire U. S. Fleet and its introduction into training of British, Canadian, and Australian armed forces. In collaboration with Robert V. Brost of the Three Dimensional Company he designed and put into production the thousands of projection kits and millions of lantern slides required in the training program. And all this within the span of 10 months.

In January, 1943, the Navy Bureau of Personnel and its Bureau of Aeronautics entered the picture. The Ohio State unit was made a command post with Dr. Renshaw retained in an advisory capacity. He resigned the post in July, 1943.

But the Renshaw experiments still go on—the most recent at the Battaille Memorial Institute, a metal research laboratory located in Columbus. In 30 training sessions, engineers at the Institute increased their reading speed as much as 150 words a minute—with comprehension ratios upped as much as 70 per cent in some cases.

What all this implies for post-war educational modifications is obvious. Basing their work largely on the Renshaw finding, the Three Dimensional Company is planning the production of tachistoscopic training sequences in three dimensions which may change the whole educational process.

For post-war aviation the Renshaw system promises airlines pilots who can, during emergencies, check instruments for "something wrong" in the stroke of an eye, and private pilots whose trained eyes will make crowded air lanes of tomorrow safer. Aircraft manufacturers are already planning Renshaw training for their inspectors.

For the present, however, Dr. Renshaw is fairly content to watch his system help win the air war. His records include reports from officers which show that his trainees top the list for enemy planes downed. And his endless files contain the detailed story of how they got that way. END

Long-Range Flight Crews

(*Continued from page 72*)

we thought this arrangement would be satisfactory. We had in effect, we reasoned, the efficiency of five-man crews since we were to fly formations. It could have worked that way but it didn't. Maybe it was the human element—plus a little bad weather.

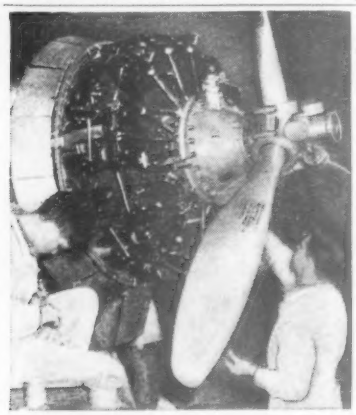
About four hours out on the first flight—we were to make many before our work was finished in that theater—we ran into weather which forced us to separate. We lost sight of each other for several hours. However, the captains of the planes without navigators were all experienced men. Over the intercoms we managed to keep contact and exchanged information so that when the weather passed we were able to re-form and complete the flight in formation. Our teamwork got us through even though we were pretty worried for some time.

Another incident which I brought about through a momentary lack of vigilance while endeavoring to perform duties of both navigator and engineer, demonstrated clearly the fallacy of expecting one crew member to function in dual capacities. Each hour our plane would burn about 70 gallons of fuel from the main tanks. In order to keep the main tank full and use up the reserve fuel from the auxiliary cells, I would temporarily become the engineer and switch on the fuel transfer pump.

I kept a log of the number of minutes each time the pump was on as well as the number of gallons pumped from each reserve cell in order to analyze correctly the flight progress against the "Howgozit" graph. After the third fuel transfer I decided it was just a routine job, so when we flew out of the overcast a few stars were visible and I decided to shoot some lines of position. As we were nearing the "point of no return," it was imperative that we obtain a fix and check our position.

Accordingly, I shot a moon sight and two star sights with my octant, and became so engrossed in calculating our position that it was like a blow on the head when the captain of the plane to our port side exclaimed over the command radio:

"Don't look now, but there is quite a



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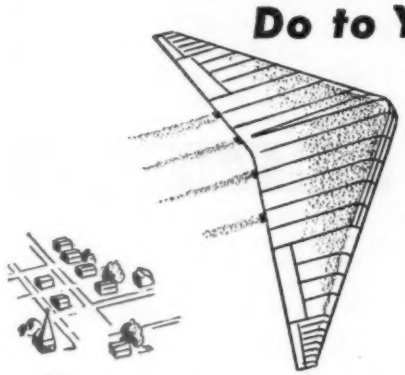

SPEEDS faster than sound, transports that literally pace the sun. You leave Washington at noon and it is still noon when you arrive in Los Angeles. This is no dream. Eminent engineers say such airliners are on the drawing boards now. You will fly in them sooner than you think. Already Lockheed's P-80, jet propelled pursuit ship, is in production.

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trail of gasoline vapor pouring from your trailing edges."

I had the pump off with his first word but it had run two minutes overtime and 10 gallons of precious fuel had been pumped out into the Pacific sky—not to mention the fire hazard this mistake had created.

This was an inexcusable boner. When we landed, the crew let me off with a fine of two bottles of beer all around. Thanks to the alert captain of our wing plane, my negligence wasn't more expensive. Continued absorption with my navigating job to the neglect of my function as engineer could have resulted in our having to ditch the ship far short of the Honolulu airport. Subsequently, when we ran into adverse headwinds and I had quite a job of navigating to do, I let the tanks overflow twice more, only small amounts to be sure, but still gas was lost.

During other flights, with our crews organized so that the navigators doubled as engineers on the two lead planes of each quartet, other navigators made this same error several times.

Though it was not possible for the engineers to function as navigators, their duties on the ground were doubled. When we landed, each engineer had two planes to check and repair instead of the usual one. These men got little sleep while we were on the ground between hops, even though they had the help of other crew members. They had to supervise everything we did, down to the smallest detail.

None of us objected to the extra duties as novice engineers during these important ferrying operations. It was an interesting experience. We are better qualified airmen because of it, but I maintain it is false economy to reduce the crew—below the five-man minimum except in case of emergency.

Lest my statements be construed as an argument for specialization by flight crew men, I want to emphasize that it improves a crew member's efficiency to have knowledge of more than one job. The captain of the plane should know the duties and responsibilities of all aboard. He is actually a supervisor who should be an experienced navigator, pilot and flight engineer as well as a radio operator.

The ideal way for a captain to acquire all of these skills is through a series of progressive promotions—such as through the jobs of engineer, navigator and co-pilot—until he eventually captains his own plane. Not only would these opportunities for advancement be an incentive for continuous learning and training but they would encourage ambition and loyalty more than any other means I can think of.

With all the new improvements to planes and flight apparatus, the gadgets and devices still remain aids to the basic methods of operation. And some of the new equipment, radar for instance, requires experts for operation. Study of qualifications, duties and responsibilities of flight crew members for planes on long trips, in my opinion, conclusively indicates that handling a four- or six-engined airplane is a five-man job at best, with at least one steward if passengers are carried. END

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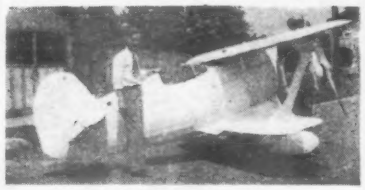

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Letters

(*Continued from page 73*)

boost its IAS to *100 m.p.h.* If the "prolonged gust" were even of four or five seconds' duration, the kinetic energy ($\frac{1}{2}mv^2$) would not be absorbed to the point where equilibrium, or the 60 m.p.h. IAS would be regained while within the gust. Hence the spread between normal cruising and stalling speeds would not be reduced so as to cause a stall when calm air is reached.

The likelihood of flying from calm air into a 40 m.p.h. head-on gust and then back into calm air within a matter of seconds is questionable. To verify our contention we presented the problem to a CAA aerodynamicist who concurs with our original reply. With reference to the analogy quoted in the last letter, there would be G's exerted on the plane. G's are a measure of acceleration, which in this case would be imposed on the aircraft by the upward movement, similar to that imposed on a human body in an upward moving elevator. Give up?—ED.

CORRECTION, PLEASE

Sirs:

You identify photo number eight on page 76 of the June issue of FLYING as a Waco CG-13 glider. I say it is a CG-4A. My 2,200 flights in a CG-4A glider make me sure of this.

LIEUT. TOM PAGE

Warrensburg, Mo.

Sirs:

In the For Identification section of FLYING's June issue you called a Short *Empire*, a Short *Sunderland*. Look at the tail, underside and nose and see the difference.

SMITH DAVIS, JR.

Cleveland, Ohio

● Readers Page and Davis are correct. We are sending our "identification expert" back to school for a refresher.—ED.

FORGOTTEN MAN

Sirs:

As an ex-WTS instructor, I believe I am speaking for many of the men in this group in asking for action in a matter that seems to me to be something that is grossly unfair.

When instructors were sought for these CAA-Army training programs, many men past 30 years of age gave up jobs and home to render what was then publicized as a patriotic duty. In 1943 these instructors were advised to enlist in the Air Corps Enlisted Reserve to avoid being drafted. The alternative: to be remanded to Selective Service with "recommendations." Now that all of us are released, we have discharge certificates showing no active duty. That eliminates any service rights insofar as personnel policies of employers are concerned.

It appears that the skills necessary to train aviation cadets are unrecognized although to me the duty seemed pretty active. It is difficult to reconcile the difference between carrying a rifle in service, or "inactively" training flight students for the armed forces.

GEORGE L. BOSLEY

Balboa Island, Calif.

END

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